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(Double Number.)

Ebening Meeting.

Monday, March 6th, 1871.

Admiral of the Fleet **SIR GEORGE ROSE SARTORIUS, K.C.B.**,
in the Chair.

NAMES OF MEMBERS who joined the Institution on the 14th February, 1871
(omitted in the last number of the Journal).

LIFE.

Maitland, H. L., Capt. R.N.

Bridges, Walter B., Lieut. R.N.

NAMES of MEMBERS who joined the Institution between the 20th February
and the 6th March, 1871.

LIFE.

Warner, Joseph H., Major 2nd Middx.
Rifle Vols.

Sharpe, Philip R., Capt. R.N.
Adeane, E. S., Comr. R.N.

Tomkins, Alfred S., Lieut. Victoria Rifles.

ANNUAL.

Aikman, F.R., V.C., Lieut.-Colonel 2nd
London Rifle Vols.

Browne, J. F. M., C.B., Colonel R.E.
Dept. Adjt. General

Edwards, H. J. Hope, Ensign, 60th
Rifles

Crichton, David Maitland M., Capt.
Gren. Guards

Hicks, W. A., Capt. 3rd Royal Lanca-
shire Militia

Egerton, Alfred M., Lieut. Royal Horse
Guards

Jones, Arthur, Paymaster R.N.

Pugh, Horace J. M., Lieut. R.N.

McCallum, G. Kellie, Capt. 92nd High-
landers

Mackinnon, D. H., Lt.-Colonel unatt.
Staff-Officer of Pensioners

GENERAL PRINCIPLES OF NAVAL ORGANIZATION.

By Captain C. J. COLOMB, Adjutant, Limerick Artillery Militia.

The first general principle I submit to your notice, is equally applicable
to both services—it is that—*organization is subservient to distribution.*

VOL. XV.

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This appears to me so self-evident, that I think it unnecessary to enter into arguments to establish its truth.

The application of this principle to either the Navy or Army, renders an investigation as to the nature of distribution necessary before organization can be approached. Distribution has to do with place: Organization with time.

When distribution has fixed the places to be filled, and the strength of the forces to fill them, its duty ends and that of organization begins. Its business is to arrange that the required forces are at the named places at the "*right time*;" that these forces are in every way adapted to the service they are to perform; and that they are provided with every requisite to enable them to hold their ground.

In 1869 I had the honour to read two papers on the "Distribution of our war forces." These may be found in No. 53 of the Journal. The principles there put forward are those on which I rest the general principles of naval and military organization. It is therefore desirable that I should briefly refer to those principles, so far as they effect the subject for discussion to-night.

1st. I submit, that the popular notion, limiting as it does national defence to the mere defence of the United Kingdom against invasion, is a dangerous fallacy. That there is no such thing as national safety without imperial safety, which involves the defence of the imperial base, against capture by assault, or *reduction by investment*, and consequently the defence of the imperial communications.

2nd. I submit that neither Naval distribution nor Army distribution can be considered apart, or as abstract questions. The Navy would have its "hands tied" without an army to secure its "bases of operations:" the Army would be powerless, being unable to move unless the safety of its communications is preserved by the Navy. Therefore as organization is dependent on distribution, and as the distribution of the Army cannot be considered apart from that of the Navy, and *vice versa*, it follows that naval distribution affects Army organization, and Army distribution influences naval organization. Hence it is that to-night I venture to address you on matters relating to our naval forces, and next week I hope to bring forward certain principles referring to the Army.

3rd. I submit that the whole duty of our Navy may be thus summed up: it has to protect our commerce during peace, and to hold the Channel, the Mediterranean, and to guard the long lines of communications during war.

4th. I endeavoured to shew that the defence of the imperial communications involves the defence of the points which command them; that our detached fleets must have fixed bases of operation, and that these must be secured to them by military force during war, and that these fleets must have arsenals capable of supplying their wants, such as coals, stores, &c. It therefore follows that "the point which commands" that portion of the communications entrusted to the care of a fleet, "its base of operations, and its arsenal," should be one and the same place; so that by securing such places from capture or from bombardment from the sea, three grand objects would be simultaneously

attained, namely: the placing an enemy attacking the Empire at the greatest possible strategical disadvantage; the creation of naval arsenals at places most conveniently situated to the scene of action of our fleets; the removal of any necessity for hampering and fettering the action of our sea-going fleets by considerations relating to the protection of their arsenals, and thus by increasing their freedom of action, we should increase their power.

By reference to these papers, you will find my reasons for considering the following places to be the great imperial strategic points, the bases of naval operation abroad. Gibraltar, Malta, Aden, and Bombay; Sierra Leone, Ascension, St. Helena, a port at the Cape, the Mauritius, Singapore, and Hong Kong; the Falkland Islands, and Sidney; Bermuda, Antigua, and Jamaica. I do not offer this selection for discussion because, whether I am right or wrong in the choice of positions, does not in any way prejudice the general principle. I wish, however, to except Bombay, as I attach the greatest importance to it, as a grand base of naval operations in the East; and I think that on its *naval* offensive and defensive resources, may some day depend the fate of our army, and our rule in India, as also the safety of our communications to the eastward of the Cape. I therefore hope to elicit some expression of opinion on the subject. The great line of defensive naval operations I take to be represented by one passing from the United Kingdom, viâ the Mediterranean, to Bombay. I therefore consider that Bombay should be the direct feeder of all our advanced naval outposts in eastern seas, in the same way as those in both Atlantics must look direct to the United Kingdom. The world is thus divided into two great districts, one with its head-quarters at home, the other at Bombay. The United Kingdom being the grand base. These great districts would be sub-divided into naval stations, each with a fixed head-quarters on the lines of communication; the limits being drawn with reference to the distribution of our possessions, and of the commerce belonging to the Empire. The duties to be performed by naval forces on these stations in time of maritime peace to protect the trading interest of the Empire at ports or on seas not in the possession of civilized powers; and in time of maritime war they would have to hold the communications; thereby securing colonial defence. We must ever be prepared to place in the Channel and Mediterranean a fleet sufficient to hold these positions. As regards the other naval stations, we must be prepared to convert the fleets suitable for peace duties into squadrons capable of meeting war requirements, and we must further be prepared to re-inforce them with war cruisers, according to their necessities. If you refer to these papers, you will find an illustration of the distribution proposed to meet these imperial requirements. Its chief features were these:—

1st. The withdrawal of the marines and marine artillery from service, as part complements of sea-going ships in time of peace, placing them instead at the head-quarters of the naval stations, as part of the naval force at the disposal of the Officer commanding the station for duty ashore or afloat. These forces would furnish in war the crews of the port defence vessels, and war cruisers laid up in reserve at each naval head-quarters, the war garrisons being then furnished by the Army.

The Officers, seamen, and marines required to raise the Channel and Mediterranean Fleets from a peace to a war footing, being kept in reserve in the Coast Guard and in barracks.

2nd. The keeping in reserve at Bombay, and at each head-quarters, war cruisers; the numbers of these cruisers so held in reserve being in proportion to the naval forces serving in peace on the station in vessels not adapted to war purposes. These peace cruisers being kept as far as possible in repair by marine artificers at their head-quarters. The war cruisers furnishing the means of transport (for the naval forces, including the marine garrisons) out and home.

These marine garrisons are apportioned to naval head-quarters more according to the number of ships supposed to be on the station and to the port defence vessels in reserve, than to the local requirements of the garrisons, so that means of instructing them and keeping them efficient as marines, by attaching them to sea-going ships, should be at the disposal of the Admiral Commanding. Any deficiency as regards garrisons, I provide for, in the West Indies, by proposing to hand over the West Indian Regiments from the Army to the Navy, for garrison duty at the naval head-quarters, and in the case of Singapore, Hong Kong, and Mauritius, by advocating the creation of a native marine force, with its head-quarters at Bombay, for garrison duty at those places.

Thus each naval station would have a distinct constitution, and independent existence under one direction, that of its naval Commander. I maintain that with the exception of Malta and Gibraltar, all the military wants of our colonial possessions, can in *time of peace*, be amply provided for by the Navy, and therefore that the foreign service of our Army at such a time could be limited to India and the Mediterranean, and thus one of the great difficulties in the way of re-organizing our Army—Colonial service—vanishes.

The real question I seek to bring to an issue, as regards my system of imperial defence, is this: can naval forces perform the duties, real or supposed, for which it has hitherto been deemed necessary to isolate and detach portions of the Army?

What are the duties supposed to be performed by troops abroad during peace? The Commissioners on recruiting the Army speak of "that military protection we are bound to afford our extended Colonial possessions." A practical example of the sort of military protection we afford our Colonial possessions is furnished by Trinidad, an island having an area of 1,754 square miles, with a population of upwards of 84,000. Here we place a company of infantry of the line. Men-of-war only occasionally visit it. Now, I ask the meeting to consider the value of the military protection we afford to Trinidad; but surely there is little use affording military protection to our Colonial possessions in peace if it is to be withdrawn in war, and military protection, without naval protection is an absurdity, and means simply the "lock out" of the military force so employed. Before we can dream of giving our Colonies military protection, we must guarantee them naval protection, which involves secure bases of naval operation at points chosen for strategic reasons. The place where troops would be required abroad in war, would

be at the naval head-quarters; and in peace (as we cannot give one-twentieth part of our Colonial possessions, troops sufficient for any practical purpose) the proper course to pursue is, to place at the strategic points of the districts to which they belong, a force sufficient to meet their rare peace emergencies, such as civil disturbance and riots. At the naval head-quarters, means of transport either by the peace cruisers or war ships in reserve, would always be at hand. Now, I would ask the meeting, would not seamen, marine artillery, or marines, or native troops under naval control, be just as efficient for service of this nature as any military body? Would Trinidad be unprotected were its one sickly company withdrawn? would not that Island and the many others in the neighbourhood, be much better protected were a small naval force for shore duty placed at Antigua, with which place there would be constant communication by the cruisers patrolling that district? Would it not be much better were this movable force and its means of transport, always at hand, controlled by one head, that of an Admiral, instead of by two, an Admiral's and General's? Again, the duty of protecting our commerce in peace, often involves minor coast operations with semi-civilized or barbarous peoples. It may happen, under the existing system, that when such slight operations are necessary, an Admiral has to concentrate his ships at the scene of action, not because he requires the vessels, but because he wants the shore service of the Officers, and men in them. This would never occur if the shore forces on the station were under his direct control, he would not have to weaken his patrols in one direction, because he required a small landing force in another.

It would occupy too much time were I to dwell longer on the general principles of naval distribution I propose, as best adapted to imperial necessities, a glance at my lectures will make many things clear which may now appear, to some present, indistinct. I will close these brief remarks on distribution, by saying that it certainly does appear to me that the pressure of a great war will break down the centralization system we pursue in peace in both services, and that each naval station should have certain resources within itself, such as, sufficient reserve of stores and means of repair, and that unless these resources are quietly developed during peace, they will be absent when sorely needed on the breaking out of war. Is it to be believed that a ship disabled in action in China is to be obliged to come all the way home for repairs and in a crippled state, run the gauntlet of opposing forces for several thousand miles?

You will find that the proposed distribution involves but little increase of naval forces; the charge for the West Indian regiments would simply be transferred from the Army to the Navy Estimates, and also the charge for native Indian Marine force proposed, would be almost covered by the transfer of the charge borne on the Army Estimates for native Indian troops in China and Straits settlement. It allows 40,000 for Channel and Mediterranean service, and 12,000 for other stations, exclusive of marines and marine artillery, the distribution of which forces was 1,800 artillery, and 7,200 infantry at home as a reserve for Channel service, and 1,250 artillery, and 4,300 infantry abroad at the

head-quarters of naval stations, distribution having fixed the forces required to be in certain positions, organization must bring those forces into action at the right time, *i.e.*, on the declaration of war. But it is well known that this nation will never in peace, keep its fleets in commission at a war strength, and therefore, the next general principle is clearly that—*naval organization must provide the power of rapid expansion of our naval forces, from a peace to a war footing.*

Now, if we test the existing system by this principle, what do we find? Unfortunately it appears that if we have to increase our naval force suddenly, we must look outside it altogether. Not a ship in commission could spare a single man, the number of executive Officers, and the number of *bonâ fide* seamen borne in each ship, are barely sufficient for its requirements; therefore, for an additional number of Officers, we should have to look to the Half-pay List; and for an additional number of seamen, we must look where we can. There is no difference between the peace and the war complement of a ship in commission, the *bonâ fide* seamen element is always at the minimum, the artificer, and non-combatant class is ever at the maximum, and yet a seaman can do many of the duties for which certain classes of non-combatant men are borne on a ship's books, but *they* can never be made seamen of. A seaman can do a marine's duty, but you can never make a seaman out of a marine. An executive naval Officer can act as a marine Officer, but a marine Officer cannot do the work of a naval Officer. An executive naval Officer could do a paymaster's work, but a paymaster could not do his. There is at present a force of marine artillery, and marines serving afloat, in number about 8,000, about 120 of which are Officers: now, I say that at all events, were these forces serving instead at the head-quarters of the naval stations—where they could be kept efficient as marines, by being attached as supernumeraries occasionally to ships for a cruise, or in unhealthy seasons sent to sea for instruction in the war cruisers in reserve—120 executive Officers, and 8,000 more *bonâ fide* seamen might be kept employed afloat during peace, and thus a ready means of expansion would be afforded; and I submit that many of the duties, for which men who are not seamen are now entered and borne on ships' books, could be performed by seamen, and that if it involved extra pay, it would be wiser and cheaper in the end, to retain in peace a larger number of seamen for those duties, and so diminish the large proportion of blue jackets who are not seamen, and whose duties require no extraordinary amount of special training, such as carpenters, butchers, barbers, tailors, shoemakers, lamp trimmers, ships' stewards, assistants, sick berth attendants, &c., &c.

If it be argued that seamen could not, or would not act in these capacities, I reply that when seamen are discharged from the service, they become useful citizens, work at trades, keep shops, and get into all kinds of billets, even sometimes they take to driving cabs, and therefore, I see no reason why they *could* not. As to the question whether they *would* or *would not*, that entirely depends on what advantages and inducements are offered to them. Much has been written and said on the subject of "manning the Navy," but the principle of naval organization to which these remarks refer, has been entirely and completely

forgotten. Except port-defence vessels, every ship of war requires a certain number of *bonâ fide* seamen, and they must be drilled and disciplined men. Where are we to find them on a sudden outbreak of war, if we do not retain their services in peace? and how can we employ them, so long as we cram our ships with men who are not seamen, whose duties might be done by seamen, and whose places would not be so difficult to fill on an emergency. A marine's duty can be learned on shore, artificer's work can also be learned on shore, schoolmaster's, ship's stewards, ship's cooks, barber's, butcher's, tailor's, shoemaker's, lamp trimmer's, musician's, and bandsmen's work can be learned on shore. The presence of "sea-legs," and the absence of "sea sickness," are perhaps the only things required to make a soldier, artificer, or barber, butcher, &c., perfectly efficient in their several capacities on board ship. Stokers, however, are a class by themselves.

The men of a ship's complement may for general purposes be thus classed—those who are *bonâ fide* seamen, those who are stokers, and those who are neither. I ask the meeting to consider whether this latter class could not be provided for by a naval or marine infantry? There is no earthly reason why a man cannot be a combatant infantry soldier, and at the same time a good artificer, tailor, shoemaker, &c., &c. There is nothing complicated or mysterious in infantry drill; habits of discipline do not surely unfit a man for trade or general usefulness in any capacity for which he may be fitted. I do not say that you can convert the marine infantry suddenly into a corps of naval artificers, but with the advantages possessed by the nature of the service, I do assert that it is possible to organize the artificer class into a corps of combatant naval infantry, and ultimately to absorb the marine infantry into it as one great auxiliary Naval Reserve, to be kept efficient by periodic embarkations from the head-quarters of the naval stations, for which they would form peace garrisons. The head-quarters of the marine infantry or corps of naval artificers, or whatever it might be called, would be a school of instruction in artificers' work. The dock-yards furnish sufficient means of instruction. Having had much experience of the time necessary to make and to keep efficient an infantry soldier, I am convinced that usefully employing men at other occupations during the greater portion of their time, adds to, instead of decreasing from, their military efficiency as infantry soldiers. The case is far different as regards artillerymen. To make and to keep efficient a gunner, requires constant and uninterrupted training. A naval or marine gunner can be taught a great deal on shore, but much continued practice is required afloat before he becomes really efficient for sea duty. Under the proposed distribution this extra amount of instruction of the marine artillery could be amply provided for. These brief remarks will, I hope, explain how I propose to obtain power of expansion in the organization of the naval forces, so far as men are concerned. I suggest filling the places of the marine forces in seagoing ships with *bonâ fide* seamen, and further, to offer such advantages as may be necessary to induce *bonâ fide* seamen to perform in peace many of those duties for which a special class of man is now entered. When a sudden increase to our fleet became necessary, these could be drafted into the

ships in reserve, for duty as *bonâ fide* seamen, their places afloat being filled by the corps of marine or naval artificers serving on shore, at home, and at the naval head-quarters abroad, the war garrisons at such a time being furnished by the Army. Each fleet at home and abroad would then have its reserve of ships and men. Each naval station would be really a training school in peace; the seagoing fleet furnishing the means of instruction for the naval forces held in reserve as peace garrisons at the head-quarters. That branch of the Navy composed of men other than stokers and *bonâ fide* seamen, would be organized as a force of naval infantry, only employed afloat in peace, for purposes of training them for sea service. It would be officered by executive Officers of the Navy, and the marine infantry would gradually cease to exist.

The Marine Artillery would, in like manner, be absorbed into the "Navy proper," and officered by the gunnery Officers of the Navy. It would then be what it ought to be—a great naval artillery reserve, both as regards Officers and men. The *bonâ fide* seamen and stokers would be organized and officered in the same way. The whole Navy would be organized as one great corps for service ashore and afloat, its reserve branch being chiefly quartered on shore, ready at any time to embark. All distinctions as to the system of discipline, system of training, dress, &c., would vanish, and that unity, which is strength, would be obtained. The peace garrisons would thus be composed of naval brigades. At certain places they would be supplemented by native infantry, similarly organized and officered for that special duty.

Now, Gentlemen, if I am told that the marine forces as at present constituted are a necessity and cannot be withdrawn from service as part complements of seagoing ships, I answer that the objection to their removal can only be based on either of these reasons, viz., that their presence is necessary in a ship on grounds of discipline, or that they are required as a landing force. As regards the first objection, I assert that the day has gone by for the necessity of upholding discipline by "physical force," and that if a ship requires marine bayonets to support authority, there must be something wrong in the system. With reference to the other objection, recent experience proves that it has no foundation in fact, for it seldom happens that marines are landed without a preponderating proportion of blue jackets. In the Crimea the blue jackets landed were immediately pushed to the front, while the great bulk of the marine forces was left at Balaklava. In Abyssinia, the marine artillery and marines were left behind, while a rocket battery of blue jackets accompanied the Army to Magdala. There is, however, one other objection which may be urged against my proposition to withdraw these forces from service afloat as part complements of ships in peace. It may be said a seaman could not do a marine's work. What is it? Sentry duty, deck work, such as cleaning brasses, manning falls, &c., &c. Now, a seaman actually does all these things, except the first. What is a sentry more than a man posted at a certain place, for a certain time, to carry out certain orders, and invested with authority for the time being to enforce the instructions he has received?

What qualities is he required to have more than faithful obedience and a reverence for constituted authority? Then why cannot a seaman do duty as a sentry? I cannot trespass upon your time by entering into detailed arguments. I am prepared, however, to do so should it be necessary. The general tenor of my views on this subject may be thus briefly expressed. If the discipline of the Navy is equal to the discipline of the marines, the latter are not required afloat; if the discipline of the Navy is inferior to that of the marines, it is because barracks, means of instruction, and proper organization are given to the marines, but denied to the Navy.

Men can be disciplined in barracks better than on board ships for the following reasons:—

The machinery required to establish discipline is wanting on board ship. The separation of bad men from good is impossible; the difficulty of placing bad characters in proper confinement great, and the scope of minor punishments limited. The number of men a ship accommodates is but equal to the performance of work to be done. If punishment involves the suspension of men from duty, others, more or less, suffer, for additional work is thrown upon them. In barracks, by granting or withholding indulgences, the comfort of classes of men can be increased or diminished at pleasure; on board ship all classes of men must of necessity be mixed together and share equally the comforts and discomforts of the service. This seriously interferes with the proper "status" of the petty officer class, and prejudicially affects the efficiency of that great link in the naval chain of responsibility corresponding to the non-commissioned Officers of the Army. To my mind, it is as necessary that Officers and men of the Navy should spend a portion of their service in barracks, as it is that naval reserve forces should be often embarked in war ships. The peace garrisons could thus always be kept full, a certain portion of the garrison, Officers and men, being periodically embarked for exercise and instruction afloat, their places being taken by Officers and men disembarked for exercise and instruction on shore. If in war naval Officers and seamen are required to serve on shore in the presence of an enemy, why should they not be afforded sufficient opportunities of learning that part of their duty in peace?

Now there is a difficulty in obtaining *bond fide* seamen, and this may be urged against the system I propose. I say that difficulty in a great measure springs from the meagre advantages now offered to such men. Without a sufficient supply of this class naval organization is useless. Seamen cannot be conjured up like "spirits from the vasty deep," they can, however, be got and retained for money, and therefore the last general principle I submit to your consideration to-night is this:—*As parsimony is the ruling principle of this country during peace, naval organization must carefully economize expenditure in its administrative departments; and as the cost of the machinery of organization is decreased, so the outlay on men may be proportionably increased without adding to the total charge.* Applying this principle to the existing system we find that the total charge for full, half, and retired pay of secretaries, paymasters, assistant-paymasters, and clerks, is by the

Estimates of 1870-71 about £176,100 a-year; the Admiralty Office costs besides £159,368, total £335,468. The total charge for wages of naval officers and men borne on ships' books is £2,215,781 a year, of this about £127,037 goes to Officers of the Paymaster's department; deducting this from the total we have £2,088,744, therefore $\frac{1}{17}$ th of the total charge for wages of the Fleet is absorbed by these Officers. But it must be remembered that the want of organization, which requires such an outlay on the clerical department, also renders proper provision as regards retired and half-pay for these Officers absolutely necessary. The sum so voted, £49,069, must be taken into account, consequently the actual cost for Officers of the clerical department for a service which costs in wages £2,088,744 is about £176,100, or nearly 8 per cent.

Now what have these Officers to do? To pay the Officers and men, to keep up the ship's correspondence, and to keep store accounts. Would not organization, involving a proper distribution of labour, such as Officers paying their men, keeping the records of issues and receipt of "slops," and carrying on, through the Captain of the ship, correspondence relative to the men of their divisions or companies, reduce the work of paymasters, and leave them little to do but keep a money abstract account, and a general supply and store ledger, and could not an executive Officer, for small additional pay, do this, assisted by a petty officer clerk?

Were the permanent records of Officers and men kept at the naval head-quarters' offices on shore at home, as is done in the marine service, how much money now needlessly expended would be saved?

Again, the full and staff pay of Officers of the marine forces is about £83,700 a year, the retired and half-pay of these Officers about £60,000, total £143,700 a year. Now what return does the existing system get for this sum. It places 120 Officers afloat and bids them do nothing. The rest of the Officers are on shore employed getting their men ready to serve under Naval Officers afloat, and are themselves under training for embarkation, when they in turn will have nothing to do. The nature of the service precludes their doing anything which a Naval Executive Officer could not do. If they are landed for shore operations, in nine cases out of ten they merely carry out the orders of the Naval Officers, and do the work of a Naval Officer on shore. On the other hand, about £155,800 a year is being paid to naval executive Officers on half-pay to do nothing on shore, because there is no room for them afloat, and because no work on shore for them can be found. Now, if naval Officers really command the marines borne on ships' books, whether afloat or ashore, why can they not command and train them for such service when the same men are borne on the shore strength? What is the extraordinary and mysterious transformation which takes place, as regards the individual man, on his transfer from one place to another, or his name from one book to another, which precludes the possibility of his being commanded by the same Officers? If a naval Officer can command, and does actually command, a body of marines abroad in the presence of an enemy, why cannot he do so in barracks at home?

Were the whole Navy organized in great divisions, as the marine forces are now, and were the non-commissioned officers and men of those forces absorbed into the Navy, the necessity for a half-pay list, and the necessity for buying out executive naval Officers, able and willing to serve, would cease to exist, and the services of 80 artillery and 285 infantry, experienced Officers would be placed at the disposal of the Army as full-pay Officers in the reserve forces, where such Officers are urgently needed, and the annual cost to the country would be represented by the difference between half and full-pay of a certain number of naval executive Officers, no present or prospective pecuniary loss, or sacrifice of rank, being inflicted on the marine artillery and marine Officers.

A standing Navy would thus be built up on the marine divisions. The whole system of naval administration would pass into the hands of executive naval Officers, as is now the established system in the marine forces; the greater proportion of the sum now expended on the "pen department" being ultimately carried to the credit of *bonâ fide* seamen in the Royal Navy.

The general outline of the scheme I propose as regards naval forces is as follows:—

1. To withdraw the marine artillery and marines from service as part complements of sea-going ships of war in peace. To quarter them instead at the head-quarters of the naval stations. To attach to these forces so quartered abroad native troops, according to the peace necessities of the head-quarters and of our possessions within the limits of the station. The whole of these men to be under the control of the Admiral commanding the station.

2. To make Bombay a great naval reserve dépôt of ships and stores. The head-quarters of the native marine force to be fixed there, and, as far as possible, this force should be combatant artificers.

3. To have at each head-quarters, port-defence vessels as required to rescue it from bombardment, laid up in reserve, and also war cruisers. The number of the latter to be in proportion to the total number of British naval forces serving ashore and afloat in the station, so that on the outbreak of maritime war the arrival of the war garrisons then furnished by the Army would let loose the whole of the British naval forces for service in the sea-going and port-defence ships which would be on the spot.

This is the outline of Naval distribution.

As regular naval organization, I propose—

1. To divide the Navy, like the marine forces, into three great divisions, with permanent head-quarters in barracks on shore at Chatham, Portsmouth, and Plymouth; each having its divisional office where the records of Officers and men would be kept, and by which all matters relating to the *personnel* of the division would be arranged. Each division would have its administrative and drill staff composed of qualified naval executive Officers. Every division should have its due proportion of *bonâ fide* seamen, artificers, and stokers, and at present the marine divisions would form a constituent part. Each division,

including its marine forces, to be under one control; governed by the same laws and regulations afloat and ashore. Thus the Navy proper and its present auxiliary—the marine forces—would be gradually drawn together and finally amalgamated. Each naval division would furnish its proportion of the forces required for duty, ashore and afloat, on the naval stations abroad, the naval forces ashore, at home, and in the Mediterranean being equal to the number required to raise the Channel and Mediterranean fleets from a peace to a war footing.

2. The reliefs for foreign stations to transport themselves in war cruisers, these being held in reserve at the naval head-quarters, whilst the forces are serving in peace cruisers and on shore.

3. The immediate employment afloat of 120 additional Lieutenants and 8,000 *bonâ fide* seamen.

4. The ultimate abolition of the half-pay list of Captains, Commanders, and Lieutenants, by the substitution of naval for marine artillery and marine Officers. These latter to complete their service in the Army of Reserve, with the same present and prospective advantages they now possess.

5. Every vessel in reserve to have its full complement of stokers. There would be plenty of work for them to do, as no other men would be employed on board as ship-keepers.

6. The artificer class to be naval infantry, and drilled also at gun drill, so as to form an auxiliary power to the *bonâ fide* seamen, which would be naval artillery. Every encouragement to be given to marine infantry men who are carpenters, tailors, &c., &c., to join the naval infantry.

7. The naval divisions could be organized in companies, as the marine forces now are. These companies would probably have to be much stronger than marine companies, but this would be a matter of detail easy of adjustment.

This, Gentlemen, is a rough sketch of the manner in which it appears to me a real standing Navy might be formed and developed, and possess, as it should, power of expansion, and economy of administration. The marines and marine artillery would lose nothing either in drill or efficiency had they a dress more suited to service on board ship. Nor would they suffer by the substitution of naval for marine Officers, *provided* the same advantages of system and instruction are afforded to naval Officers by quartering them on shore to learn, instead of turning them adrift on half-pay to wait till they are wanted afloat.

Discarding as ridiculous and absurd the tight clothes, straps, and buckles of marines, I can conceive no better model of naval organization than the existing marine system, as regards broad principles. Most people think it is exactly the same as the Army system, but it is not. Indeed, it is essentially different. Few persons understand it; fewer still appreciate it. It has been the silent, quiet work of generations of unknown Officers. Severely tried and tested in all sorts of ways, it has never failed. But its vitality as a distinct service, for special purposes, is gradually being crushed out of it by the steady exterior pressure of an advancing naval system. It is now not much more than a "stop-gap" for trifling deficiencies in that system, a

"make-shift" to cover flaws and defects. This state of things is detrimental to both the naval and marine forces, and consequently injurious to national interests.

The marine force, as at present constituted, was cradled in the most gloomy period of naval history; it attained its full stature when discipline in the Navy had to be sustained by force, and the necessity for its independent existence ceases with the birth of a new order of things in the Navy.

Therefore, Gentlemen, I would fain hope that out of the ashes of a worn-out and dying system, a real standing Navy may arise like a phoenix, conscious of its own inherent power, mighty in its own strength. Under its outstretched wings—reaching to the uttermost parts of the sea—should the Colonies and outlying possessions find sheltering protection in peace, and the whole Empire find safety and security in war.

Rear-Admiral RYDER: I should like Captain Colomb, when he replies, to point out the difference between the French system and the English.

General SCHOMBERG, C.B., R.M.A.: I was in hopes that some sailor would have addressed the meeting. I am sure we are all very much obliged to Captain Colomb for the clear lecture he has given us. But there are one or two doubts in my mind. One is a naval doubt, that can only be determined by a sailor, that is, whether sailors will remain sailors if they are kept long in barracks, and subjected to the drill and discipline which the marines now undergo? The next question is, supposing a great war broke out, a coalition formed to attack England, and not a favourable neutrality on the part of America, we should require every ship we had got, would the system which Captain Colomb has sketched, be elastic enough to meet the pressure upon us? If a break-down should occur, you would not be able to fill up your gap with disciplined men, but with sailors who have not been disciplined, and we should have the old story over again.

Captain P. H. COLOMB, R.N.: The great principles that the lecturer has enunciated have been germinating, I may say, ever since my time in Her Majesty's Navy. I hold that Naval Officers are coming to the conclusion—which is gathering strength every day—that the marine forces are an anachronism. It is a common subject of conversation among us how, as the lecturer has pointed out, the marine forces are invariably made ship-keepers, while the naval forces do that duty on shore which the marine forces are supposed to undertake. In the West Indies during the disturbances in Jamaica, and in Abyssinia, wherever, in short, there has been an opportunity for naval forces to land, the naval forces have acted under the command of Naval Officers, and have done their work, as everybody allows, admirably. The fact is, the Navy is becoming more and more a military service; a state of circumstances is coming which, whatever we may say or whatever we may think, will bring it closer and closer every day to the present marine forces, save and except that they will always be sailors, I hope, and never soldiers, and nothing else. The difficulty I have in dealing with a scheme of this kind is its immensity, and I suspect that that is the difficulty which has kept Naval Officers, who are much more capable of speaking on the subject than I am, from criticizing the lecturer's views. It is a very large subject. The lecturer does not hesitate to attack the question on broader principles than any on which it has ever been attacked before. It is an age in which we dislike broad principles. We like little peddling objections, little, carping, criticizing questions, and we dislike to take a firm grasp of a subject, to go thoroughly through it, and to carry it out; I therefore despair of the lecturer's views, excellent though I think them to be, ever being carried to their full extent. At the same time I must say that I think both services, the naval service and the marine service, owe a debt of gratitude to anybody who will come forward and speak distinctly as to the views which he holds in his own mind, and which have, no doubt, been gathered up from conversations with all ranks of Marine Officers and Naval Officers. Adverting

for a moment to the question of laying up war cruisers in foreign ports, there are, of course, some of those carping difficulties that we have to deal with. It must be supposed that to lay up at such a place as Malta, at such a place as Bombay, or Jamaica, any considerable number of war cruisers, ready to go to work when war broke out, would necessitate the accumulation at those places of a considerable quantity of machinery, stores, and artificers. We should then come to the question of expense, whether the expense on that particular point where it was proposed to lay these ships up, would be productive when war actually broke upon us. We should say to ourselves, "Will that point be a point where pressure will be brought?" The consequence of these thoughts will be, that any concentration of war-ships which takes place, will take place, as heretofore, in England. But I do not think that that affects the general principle which the lecturer has laid down. As to the advantage of making Bombay a *dépôt* for our Eastern naval forces, that has been secured to some extent already. Bombay is the point of concentration for our East Indian forces at present; no doubt it might be made much more so. But here again we come to those carping difficulties that I have adverted to. The difficulty at present respecting Bombay is that the repair of our ships is done by the Indian Government, and a very good thing the Indian Government make of it, for they invariably charge us about double the cost of all repairs. In the event of making Bombay an imperial base, the Home Government would have to buy its own land, to establish its own dockyard, and to keep its own artificers, otherwise there would be endless troubles and disagreements with the Indian Government. I have spoken only because there seemed to be a difficulty to get people to speak on the subject, and I do not think it is one which ought to be allowed to pass unnoticed.

MR. T. BRASSEY, M.P. : As a Member of Parliament, anxious to be enlightened upon naval affairs, I should like to ask the gentleman who has read the very able and interesting paper, one or two questions, which I hope he will put down in his list of questions to be answered, when he makes his reply. First of all, may we not anticipate that in future naval wars the numerical strength of the *personnel* required for the Navy will be much less considerable than in the time of the last great naval war? I believe that in the great days of the Navy, in the time of Lord Nelson, the number of seamen and marines voted for the Navy for a considerable succession of years, was about 170,000 or 180,000. I assume, but I should like to hear our lecturer's opinion upon that subject, that those days are not likely to recur, that in anticipation of the introduction of mastless ships, and the universal application of steam propulsion to ships of war, and having regard to the number of guns carried by ships, fewer guns and much heavier in point of weight and metal, we may anticipate that the numerical strength of the *personnel* necessary for a great naval power, will not be so considerable as in former times. Then with regard to artificers, I think the lecturer seemed to suggest that we should be enabled to keep a larger number of seamen in training on board cruising ships if we dispensed with the presence of artificers in times of peace on board those ships. Now, I remember it has been stated by several eminent naval authorities before the Royal Commissioners and Parliamentary Committees of Inquiry into the subject of manning the Navy, that one circumstance which rather tended to the destruction of the naval efficiency of our Fleet at the present time, was the length of time passed in harbour. And it was explained, I remember, by Captain Sherard Osborn, when giving his evidence before the Committee, that this was likely to lead to a serious deterioration of seamanship-knowledge in our young naval Officers; and I remember that Lord Clarence Paget suggested that if a greater number of artificers were kept on board ships, there would be less necessity for their being frequently taken to the dockyards for the purpose of repair. I need scarcely add that the great mechanical talent which has been applied to the equipment of ships of war in recent days has necessitated the skill of the artificer for repairs more than was necessary in former times. It, therefore, seems to me, that if we dispense with the presence of a considerable number of artificers on board our ironclad ships, which are fitted with so much mechanical contrivance, that it will result in vessels being taken to the dockyard more than they are now, and thus lead to some deterioration in the efficiency of the naval service. Previous speakers have hinted at the difficulty arising from the conversion of the sailor into a soldier. I remember within the last three or four weeks having discussed

this subject with several naval Officers on board some of Her Majesty's ships at Malta; they told me that that particular turn of mind which makes a man do sentry duty with great steadiness and efficiency, if it was thoroughly inspired into a sailor's mind, would rather destroy that dash, and *élan*, and activity which it was desirable sailors should display on certain occasions. I should like to hear what the lecturer has to say about that. I very much appreciate what was suggested with regard to the laying up of ironclad vessels at our distant foreign ports,—vessels not fully manned in time of peace, but still ready for action when the day arrives. I have often thought, in looking at the old "Hibernia" at Malta, a vessel which would never go to sea again with effect in these days of ironclad ships, that it would be very desirable if Government were to provide an efficient ironclad, on which the flag of the second in command at Malta might be hoisted. I have no doubt the same principle might be applied with great advantage to many other foreign ports. There is one other point. May I ask the lecturer if he has ever thought of the desirability of training a portion of the marine artillery as a torpedo corps? That suggestion has been made in one of the recent reports of the Secretary of the United States' Navy.

Colonel JERVOIS, R.E. : I may mention on that last point, that the organization of a torpedo corps is being considered at Chatham, with the view of establishing such a corps in the Royal Engineers. We only await the orders of Government to carry out such a corps, whenever funds may be at our disposal for the purpose.

Mr. BRASSEY : I hope there will be abundance of naval knowledge also in the corps.

Colonel JERVOIS : No doubt it would be part of the plan. The organization of the torpedo corps would necessarily be that it should be carried out in conjunction with the Navy, not as one exclusive corps, but as a military corps, and as far as necessary a naval corps also.

Captain GOODENOUGH, R.N., said that he wished to record his adherence to many of the opinions put forward in the lecture, and suggested that part of the scheme,—which might be called the easy part,—viz., the disembarkation of the marines from the service afloat, and the employment of an equal number of seamen might be carried into effect without difficulty, at once; the marines being employed in future in garrisoning our foreign possessions.

Captain WHEATLEY, R.N. : I wish to make a remark upon a question that has just been asked about the torpedo, with respect to a corps of marines being trained for torpedo service. Harvey's sea torpedo is the most effective one, and is essentially a naval Officer's question. The sea torpedo is not like a mine under water; it is more like a shell, which is under the guidance of the Officer in command of the ship from the moment it is detached until it strikes the enemy's vessel. Therefore, it is more a question for the naval Officer than for the marines or engineers. I shall have to say something more upon this subject on a future occasion, when I address you on a different subject.

Commander H. W. BRENT : To follow up what was said just now about the marines being disembarked, I think the practice is gradually growing in that direction, for if I mistake not there are some five or six colonies to which marines have been sent, and therefore the proposal of the lecturer would be merely carrying out the principle much further. I have heard marine Officers say continually that they feel their time is passed for serving on board ship. As one of them, a dear friend of mine and brother Officer of the lecturer, said, "Where could I get so much money for doing so little?" That was a quaint way of putting the matter. With this feeling on their part that they have nothing to do on board and that the time is coming for them to do duty on land, and also being already in some colonies, the suggestion of Captain Goodenough to carry out part of Captain Colomb's scheme, viz., to land the marines at Malta, Gibraltar, and other places, and to put seamen on board ship instead, would be attended with great advantage. We should then be able to train a larger number of seamen, and in case of war we might divide one ship's company between two ships, and embark a proportion of marines and landmen on board each ship, and the marines would be as fit as they are at present if they had the sea work advised by the lecturer. As to blue jackets doing the duty of marines on board, that practically happens now. Two or three times a week in the

Mediterranean, it is a common thing to find sailors doing the duty of marines on board ship. It is rather a startling proposition of the lecturer, that the naval Officer should take charge of the marine forces, one is hardly prepared for it; it is going a long way. With regard to artificers, we have in all our ships a very large number of artificers. They are useful men. But if we could combine *bond fide* seamen, who could do their work as seamen and and who could also do the work of artificers, it would be a great advantage to us. As to the rest of the paper, the subject is so large that, without reading it over carefully and studying it, I should not like to make any remarks, except that at present I fully concur in all that I have heard.

General Sir WILLIAM CODRINGTON: It is perhaps rather bold for any Army man to get up on any question connected with the Navy; but there are one or two points that I think are deserving of attention. In the first place, my impression is that the marine on board ship forms part of the gunnery business of the service; that is to say, he is told off to man the guns. Is not that the fact? If that is the case, and you are to land the marines, how are you to work the guns? Or, am I to understand that you are to do away entirely with marines on board, on purpose to have able seamen instead? If that is the object, of course the marine would be no longer a marine; he would virtually become an armed soldier, garrisoning a particular colony. That is all very well; but then we should bear in mind that the marine is a much more expensive soldier than a soldier of the Line. At all events, as long as he is employed afloat there is no question that he gets more pay, and he gets his rations free. There are other questions which I need not go into; but as far as the actual expense of the man goes, if you transfer him to shore service you certainly make him a much more expensive service to garrison outlying places than the soldier. That is a question not for the Services exactly, but for the Chancellor of the Exchequer. With regard to torpedoes, I apprehend that there are two sorts that will come into play hereafter; viz., those which are for the defence of harbours, in which case, certainly, the land forces would come into operation, particularly the engineers, because they know the exact lines a ship must pass according to particular soundings, they must be prepared on shore. I apprehend—I speak under correction in the presence of Colonel Jervois—that in the defence of Venice and other places, it was proposed that the moment a ship crossed particular lines of bearing the ship should be destroyed from on shore and not from afloat. Such a proceeding would be a question for the engineer service on shore. But there is another sort of torpedo which has lately been brought into experiment if not into practice, by purely naval means, that is to say, by boats or small vessels carrying torpedoes in themselves. That is decidedly a question for naval men. I think on the question of torpedoes there will be those two distinct services, one of which must belong to the shore service, and the other probably to the naval service.

The CHAIRMAN: Captain Colomb will now reply to the observations that have been made.

Captain COLOMB: The discussion has taken a more favourable turn than I expected, for I find that a great number of gentlemen, who have had more experience of the Navy than I have, agree with me. First, with regard to the French system, I would not like to say what the difference between my system and the French Marine system is, because I am not sufficiently well acquainted with the French Marine system; but I know there are many points precisely similar. As I understand it there is great similarity, with the exception that my system would entail that every naval station should be a school of instruction; that the Marine garrisons ashore should be periodically exercised in sea-going ships, and therefore would be kept efficient. That I know is not the case in the French service. With regard to General Schomberg's question, whether the proposed system would be sufficiently elastic, I answer, that I think it would be more elastic than he supposes; because at present you have a certain force of marines, and a portion of them are serving in barracks at home and a certain portion serving on board ship. I propose to remove those men from on board ship to serve on shore, the whole force on shore being kept efficient by periodical embarkations. Consequently you would have more seamen on ships, and you would have the marines by periodical embarkations kept up to their present efficiency.

General SCHOMBERG: You would have to man all your ships, to man all your

colonies, and such places as Liverpool and Glasgow. The number spoken of by Mr. Brassey is very much within the number that we should want to defend England and the Colonies.

Captain J. C. COLOMB: You must remember, when we speak of manning the colonies, and when we speak of the number of ships which we should have to man for war, that your marines would be all serving on board ship, and it is then you come upon your garrison army to take their places.

General SCHOMBBERG: Unless you could make your system elastic enough for 150,000 or 180,000 men, I do not think it would be sufficient.

Captain J. C. COLOMB: I do not presume to fix what are the requirements of our Navy in time of war. I do not believe myself that any person can do so. I only take the naval forces as Parliament gives them to us, and I say I believe that under the system I propose, a greater power of expansion would be obtained than under the system you now possess. With regard to Mr. Brassey's remarks, the first point I have to reply to is as to the probable numerical strength of the *personnel* of the Navy which would be required in war. I have said just now I believe that is a thing that no person knows or can possibly estimate now. It is so long since we have had a maritime war, that it is impossible to fix beforehand the requirements of a great nation like ourselves, with extended territories, with thousands of miles of sea communications. And another point is, that the requirements of our Navy will depend upon the quarter from which war comes. If war threatens us from a European power, the pressure will be brought to bear upon us in the Channel and the Mediterranean. If we hold the Channel and the Mediterranean—which we must do if we are going to defend the empire—then I say the European power would be comparatively powerless to attack our other communications abroad. That being the case, it becomes really a question of the amount of force required in a special class of ship: a ship suited to the combined action of fleets, to meet the pressure of war in the Channel and the Mediterranean. That could be easily ascertained, and we could soon determine the number of ships that would be required. But take the case of a war with America; here the circumstances are totally changed. The whole of our communications are exposed; the Channel and the Mediterranean are less likely to be attacked. If you consider the enormous wealth of our commerce afloat, the innumerable vessels employed, and if you take a chart of the world, and look at the defined tracks which are our imperial communications, and then look at the position of America, you will see that those communications are all exposed to her attack. And what would be the nature of her attack? We know perfectly well. An Officer of the American Navy has told us. I think I mentioned it in my lecture; perhaps, it is as well to mention it again. It is in a paper read in this Institution, and it is well worthy of everybody's attention:—"American Navy, its Organization, Ships, Armament, and Recent Experiences;" by J. Randolph Hamilton, *Journal*, vol. xii, No. 49. He says:—"It needs no penetration to divine the naval policy of the United States. It is to hold its coasts and harbours safe from blockade and attack. With the coast secure and the harbour open, the ocean is to be covered with a swarm of swift cruisers and letters of marque." That being the case we must meet them with their own weapons. Therefore it is impossible to estimate what our naval requirements would be in the case of a war with America. All I attempt to bring forward in this paper is, that with regard to the forces we have in existence, I believe there is a waste of force; and that we have not got that power of expansion which we should have. With regard to the artificers, I am afraid I did not make myself sufficiently clear, because it is not my intention, nor could I in any possible way suggest that artificers are to be dispensed with. I only propose this, that the artificers should be made thoroughly efficient in their schools of instruction at home, kept up to their work by being employed at the head-quarters of naval stations abroad, in their artificer's duty. At home they would have the dockyards; abroad, they would have the constant repairs which ships would require; they would be kept efficient as naval artificers by periodical embarkations in the ships on the station. Therefore, really, the artificers would be better instructed. In truth, we should be better off for artificers, because in peace I propose to get seamen with increased privileges to do the work that is done by artificers. Therefore, when a seaman is shipped on board a

man-of-war, he would not lose the artificer's work he had picked up on shore; and, at the same time, he would be an efficient seaman. With regard to the probable injury done to seamen by making them soldiers, I do not propose to make them soldiers to begin with. There is a great distinction between a soldier and a sailor. But I propose that seamen should have that discipline which will enable them to do the work of soldiers, that they should have just sufficient drill to enable them to do the work which they are often called upon to perform now, in shore operations before an enemy. I speak under correction, in the presence of naval Officers, who know better than I do, but I believe that the seaman gunner of the Navy may be taken as the representative man of the advanced naval system. That being the case, let any person who pays a visit to Portsmouth go on the common—I think Friday is the day—and see these seamen drilling—I can use no other word—admirably. There is no doubt they can do this, and they absolutely do it; and if naval Officers tell me that these men are not less efficient as sailors, I think we are bound to take the opinion of naval Officers. I would not enter upon the subject of a torpedo corps, because I have already occupied too much of your time. I will just conclude with a remark upon what Sir William Codrington has been kind enough to say upon this subject. I do not propose to make the marine a pure soldier for garrison service. I take a station. In the head-quarters of that station I place a peace garrison. That peace garrison I propose to place under the command of the naval Officer commanding the station. I propose that they should perform the peace duty of the garrison. I also propose that the seamen on that station should also have their turn of duty on shore occasionally, and that they should fill the places of those who are embarked for service afloat for instruction. If the Admiral had a hundred or a thousand marines on shore at the naval head-quarters, he would have the means of instructing those men at that station by taking them on board ship for a certain time. Where there are native troops, he could in unhealthy seasons remove the whole of them by manning the war cruisers; therefore, the marine would not cease to be a marine. He is more expensive, but his value would be increased, because he would still be a marine, and would have these periodical embarkations. There is one point to be careful about. I do not propose to place such a force of marines at any station in time of peace, as to render it impossible for the Admiral to employ that force as a naval force in time of war. I believe I have now in a few words replied to the observations that have been made, but there is just one very important part of Sir William Codrington's remarks which I should like to bring to your attention. He spoke about gunnery. I should like to read an extract from Lord Lauderdale's evidence given before the Commission with reference to the gunnery question. You can read it in the Blue Book. He said, "The marine artilleryman, I think, is totally thrown away on board ship, for if we can get a seaman capable of being captain of a gun, we put him to it because we do not like the guns of the Navy taken out of our hands, and the consequence is that the marine artilleryman, except when out on shore with a field-piece, very seldom does his legitimate duty."

SIR WILLIAM CODRINGTON: I am not speaking of the marine artilleryman, I am speaking of the ordinary Marine Light Infantry, who, with the other seamen, are usually employed to man the guns. I believe I am right, but there are many naval Officers present, and they will correct me if I am not. I think the marines on board ship are told off, indiscriminately, with the blue jackets to work the guns of the Navy.

Captain DAWSON, R.N.: It is true that out of a crew of 14 or 20 men, two marines are told off to these guns, but those marines are not necessary; they have no post at the guns. They are told off generally because they have strong arms, not that they are necessary to the working of the gun. On the contrary, where they are most useful is with small arms, not as gunners.

SIR WILLIAM CODRINGTON: I do not know whether in line-of-battle ships there is the same proportion of marines now as in former days. In former days—I speak under the correction of naval Officers—there were say 100 marines on board, and those 100 marines formed part of the men who worked the guns. If you have not marines there, you must supply their places.

Captain BRENT: That is what the lecturer says. Take the marines out of the ship, and put blue jackets in.

The CHAIRMAN: I have listened with a great deal of interest to the paper which has just now been read. There are so many good and important points in it—(and this is the first time that they have come under my observation)—that I cannot venture at the present moment to criticise them in the way I should like to have done. I hope to be able to do so at a later period. The paper is full of excellent suggestions, which cannot be all carried out, perhaps to the full extent, but certainly to a considerable extent, and very much to the advantage of the country. So many changes and innovations have taken place since I took an active part in my profession, that I am rather puzzled to know what is best to be done at the present moment, with our very hazy future before us. One subject touched upon, excites a good deal of interest, and that is the proposition for altering so strongly the old status between the marines and the blue-jackets. A line-of-battle ship in which I served was saved from being carried over to the enemy by the blue jackets, principally by the aid the marines gave to the Officers. Although the discipline on board ship may not be so severe now as it used to be in my early days, still very light causes will make men mutiny; and when once a mutiny has begun, there is no knowing where it will end, unless the Officers can depend upon a distinct body of men to support them, such as the marines, between whom and the sailors there is never much sympathy, and who rarely have any interests in common with the sailors. We must remember the loyal assistance of the marines saved our fleet in the great mutiny; and as I have just stated, the support of the marines saved the ship on which I was then serving as midshipman. Therefore, I confess that the recollection of such facts make me reluctant that there should be a change, at least to the extent that has been proposed. With regard to the preparation that must be made against outbreak of war, I think with Captain Colomb, that arrangements such as he has pointed out should be made, would be wise and prudent. There should be stations, strongly defended as points of rendezvous for the different squadrons to meet, repair, and replenish. But where those stations are to be fixed, depends upon the turn events are likely to take, and what nations are likely to be the combatants. Formerly there were only two nations that had any right to be considered first-rate naval nations; indeed, only one, that was France. Now we have several nations that can bid for that rank. The system of naval warfare has been entirely changed. Steam has been introduced, and instead of relying upon a large body of our experienced sailors, the creation of long years of toil and practice at sea, we must now bow our heads to the engineer, the stoker, and to the artilleryman who has got his sea-legs. A vessel of 4,000, 5,000, or 6,000 tons, which would have required some 1,200 or 1,500 men as sailing vessels, can now be managed with much less than half that number, and with an infinitely smaller number of guns, but those of gigantic calibre. Therefore, a Navy now-a-days can spring up like a mushroom. Any great military nation can get up a large navy in the course of two or three years, and numerically as formidable as our own, and probably supplied from our own private firms, at least a large proportion of the vessels. Therefore, the utmost attention is required of our Government to make those arrangements that shall enable us to meet any combination of those nations, which in the course of four or five years may become important naval powers. This will require a considerable outlay on our part, in preparatory means, and a considerable degree of care, skill, attention, and forethought in fixing upon the necessary precautions to be taken in the different parts of our vast empire, where nations possessing these newly-created navies would attack us, just as likely in India as in the Mediterranean, or upon our own shores. These are points of the utmost importance, which a wise Government should look to at once. There are many other points of interest, but time will not permit me to enter upon them. I must, therefore, content myself with expressing my great satisfaction at seeing so young a man employing himself in a manner so much to his credit, and so much to the probable advantage of his country.

Evening Meeting.

Monday, March 13th, 1871.

LIEUTENANT-GENERAL SIR PERCY DOUGLAS, Bart., in the Chair.

NAMES of MEMBERS who joined the Institution between the 6th and 13th March, 1871.

ANNUAL.

Major-General H.R.H. the Prince Christian of Schleswig-Holstein, K.G.
Hamond, Robert N., Lieut. R.N.
Digby, Honble. E.C., Lieut. Gren. Guards.
Barlow, A. Pratt, Capt. Royal Berks Militia.
Godman, Charles B., Lieut., Royal Sussex L. I. Militia.
Cass, A. H., Major h.-p. late 10th Hussars.

GENERAL PRINCIPLES OF MILITARY ORGANIZATION.

By Captain J. C. COLOMB, Adjutant Limerick Artillery Militia.

GENERAL SIR C. T. NAPIER said that success in war depends on the fulfilment of two great principles—"to be in the right place, at the right time." I think this maxim furnishes the real clue to a solution of the problem, "Army Organization."

Now distribution has to do with place, organization with time. The nature of distribution best adapted to our imperial requirements must first be settled before organization can be fairly and properly dealt with. We must know the places to be filled and the strength of the forces required to fill them. This it is the duty of distribution to determine. Having done so, organization steps in, creates the forces, holds them in readiness to be at the named places at the "right time," and sees that they are provided with every requisite, and that they are in every way adapted to the service they are to perform. Without entering into arguments or examples to establish its truth, I submit this first general principle to your consideration.

Organization is subservient to Distribution.

Now the "right time" is undoubtedly the "moment war is declared." The question therefore is, what are the places to be filled by military forces on the declaration of war? In No. liii of the Journal of this Institution you will find my answer to the question, in two papers on the "Distribution of Our War Forces." As the principles there put forward are those on which I rest the principles of "Military Organization," it is necessary I should briefly speak of them now.

1st. I show that it is a popular fallacy to suppose "invasion" is our one great danger; these islands are nothing more than the imperial base of operations, and must not be merely secured from capture by assault, but also from reduction by investment.

2nd. *To the Empire as a whole* I apply this principle, viz., "The distribution of forces in such a manner as will best secure the imperial base of operations, and ensure safety and freedom to the imperial communications."

3rd. I propose to place and keep forces in such a position during peace as will best enable them to act on the declaration of war, no matter from what quarter it comes.

4th. I hold that two armies are required, one a garrison, the other a field Army, and I show that the garrison Army is auxiliary to the fleet, and that the fleet is auxiliary to the field Army, and that neither the distribution of the Navy nor that of the Army, can possibly be treated as abstract or distinct questions.

5th. I maintain that British military forces are not required in peace to serve abroad, except in India and the Mediterranean.

As the protection of our Colonies and possessions can best be secured by defending their communications in war, I propose to throw their protection in peace on naval forces ashore and afloat, supplemented by native marine troops. Instead of giving certain outlying possessions detachments of troops, I propose to rear imperial fortresses at the "strategic points" of the imperial communications, and to place at these points in peace naval forces for shore duty, of a strength sufficient for the ordinary peace emergencies of our Colonies and possessions in the maritime districts, of which these points are the base; with a reserve of war vessels, which would furnish means of transport for the garrisons, and in which these forces would embark in war, being then relieved by the garrison army.

6th. The imperial strategic points are named in those lectures, and I submit they would all require military garrisons in time of maritime war.

The same war which would threaten our home fortresses would also threaten those in the Mediterranean, and a combination between America and a European Power or Powers would necessitate our filling up the war garrisons at the whole of the imperial strategic points at home, in the Mediterranean and elsewhere.

I define the *defensive* duties of the "Field Army" to be as follows:—"To defend the assailable coast line of the United Kingdom and to occupy and hold India." Now this field Army would be unable to move without the Fleet, and the Fleet could not move from its great arsenals and bases of operation unless they are secured by the garrison Army; hence it is that the organization of the garrison Army is of first importance. Its strength I estimate at 120,000. Thus—70,000 for home fortresses, 30,000 for Mediterranean, and 20,000 for other Foreign strategic points; considering that these are 14 in number, and that Bombay is one of them, I cannot think the estimate too large. *A certain proportion must be liable to and held ready for service*

abroad. That proportion is represented by the force required for the war garrisons of Malta and Gibraltar added to the war garrisons which may at any time be required at the other foreign bases of naval operation; in other words, at the other imperial strategic points abroad; this, for the sake of illustration, I assume to be 20,000. Therefore, out of a garrison Army of 120,000, the conditions under which 50,000 serve must not preclude the possibility of sending them on foreign service. Hence my reason for thinking it a mistake to suppose that our garrison Army can exclusively, or in any largely preponderating proportion, be furnished by forces only liable to home service, and consequently that the common opinion that soldiers in a third period of service who are to be set apart for garrison service, and are, at the same time, not to be liable to foreign service, is false in principle. For the same reason I maintain that we cannot look to militia to supply the garrison force required, they can only be used to supplement it. The application of the general principle renders it tolerably clear that out of a garrison army of 120,000 but 70,000 could possibly be furnished by militia, or any other force only liable to home service.

The next general principle to which I desire to draw attention is this:—

A certain fixed proportion of the garrison Army must be fully trained artillerymen, and the exact proportion is a matter of possible calculation, the nature and extent of the works to be defended being known.

The application of this principle necessitates an enquiry—first, as to What is a fully trained artilleryman? Secondly, What is the certain proportion required?

Now it appears by the Defence Commission Report, that “in three months men previously untrained might be made capable of performing most of the duties of garrison artillery, when supported by a due admixture of fully trained men.” And the Report goes on to say, “the proportion of thoroughly trained and skilful artillerymen required for coast defences appears to depend, to some extent, upon whether the guns are intended to fire shot or shells.” This was written in 1859; we are now in 1871. I ask all present, with these sentences before them, whether the advance of artillery science has or has not increased the proportions of the “due admixture of fully trained artillerymen” it is necessary for this empire to maintain as part of its garrison army?

The then Deputy Adjutant-General of Artillery was examined before this Commission, and proved that at that date if “but *one-fourth* of the guns mounted had to be manned, there would be a deficit of 10,000 trained gunners, and 10,000 auxiliaries.” In the face of this evidence, and though the recommendation of the Commission added upwards of 2,000 guns to the then existing number, in order to increase our field artillery we are reducing our force of garrison artillery. The Royal garrison artillery in the United Kingdom is, according to Mr. Cardwell's statement, now 7,419, 155 less than the number at the date of the Deputy Adjutant-General's evidence referred to, and the number of guns now to be manned at home is, according to the Defence Com-

mission Report, about 2,700 more. We have, in fact, increased the number of guns enormously, and diminished the number of fully trained gunners.

You will find in the evidence of Sir John Burgoyne the following remarkable passage:—"My fear would be of establishing works permanently at very considerable expense, and afterwards, perhaps, 'being forced to abandon them for want of troops.' Now, Gentlemen, 'works have been established at very considerable expense,' and I think there are good grounds for believing that the 'due admixture of fully trained artillerymen' (without which those works might have to be abandoned), is 'conspicuous by its absence.'"

Evidently the Commissioners did not consider a man of three months training to be a fully trained gunner. The fall of Fort Avron, and the siege of Paris, confirms the view that four months' training, even while facing the realities of war, is not sufficient to make fully trained garrison artillerymen. The evidence given before the Commission on Recruiting, by those who ought to know best, proves that it takes about two years to make a gunner. Such being the case, the only fully trained artillerymen available for garrison service are serving in the ranks of the Royal (Garrison) Artillery.

By the evidence given before the Defence Commission you will find that, in order to sustain an engagement from any given number of garrison guns, two-fifths of the force at least must be trained artillerymen. If, therefore, we require a garrison army of 100,000 for home and Mediterranean fortresses, 40,000 may roughly be considered as about the number of trained artillery necessary; and be it remembered that if circumstances required the presence of war garrisons at the other defended points abroad, 8,000 more would be sorely needed. To meet this possible demand we have not 12,000.

We have certainly a paper force of militia artillery of about 15,000. The evidence given before the Defence Commission shows that the militia artillery "might fairly be trusted after six months' training, as 'auxiliaries.'" Lord Airlie, in his letters to the "Times," explained that with the ordinary time and means allowed for training a militia artillery regiment, the men could only receive a few days' instruction in gun drill out of one month's training.

It is evident that as the efficiency of the militia artillery is increased, so the proportion of the "due admixture" of royal artillerymen required for home defence diminishes. To make an artilleryman, two things are wanted, time and means of instruction, such as guns, stores, &c. It is useless to extend the period of annual training or preliminary drill if the appliances of artillery instruction are absent. Now, considering that the corps of militia artillery are scattered over the face of the United Kingdom, is it reasonable to suppose modern ordnance is to be taken from the fortresses at home and abroad and sent to places where it is not wanted except for mere drill and instruction purposes? Surely the great home fortresses have the first claim for modern ordnance and artillery appliances, next to them those in the Mediterranean, and then the other defended points abroad? Are we to rob the imperial ram-

parts to supply corps of militia artillery north, south, east, and west, with means of instruction? If we are not, then I say either two-thirds of the militia artillery will annually be instructed to use stores and guns obsolete, or fast becoming obsolete, or they must be exclusively furnished by the districts in the immediate neighbourhood of those true schools of garrison artillery, the great home fortresses. In other words, militia artillery corps which are placed, or have placed themselves, in districts where there are neither forts nor batteries of great strategic importance, should be converted into infantry, and the required proportion of militia infantry in the neighbourhood of home fortresses should be converted into artillery. For the same reason the headquarters of the brigades of garrison artillery should be fixed at these places, and thus the guns and stores supplied for actual service would furnish the means of instruction for the Royal Garrison and the Militia Artillery.

Were these militia artillery corps embodied for one year at these places, which are their natural, and would be then their local headquarters, and each man joining subsequently had to undergo one year's instruction on joining, the proportion of the "due admixture" of Royal Garrison artillerymen required for home fortresses might possibly be reduced to zero. Under these circumstances the strength of the Royal Garrison artillery required would be 20,000—12,000 for Mediterranean, and 8,000 for other foreign "strategic points." The force of militia artillery would be 20,000. Thus each brigade of Royal Garrison artillery would have a brigade of militia artillery of corresponding strength attached to it—with the same head-quarters, the same staff of instructors, and under one control. Each corps of militia artillery would thus be annually trained at the guns they would have to use, and in the batteries they would have to man when called out for actual service.

In a garrison army of known strength, a certain proportion must be engineers. The actual and exact number of this force required depends in a great measure upon local circumstances. For the sake of illustration, I assume it to be an average one-twentieth; therefore, out of a garrison army of 100,000, about 5,000 would be the number of engineers. But when 20,000 garrison artillery are required abroad, the proportion of engineers so required would be 2,500; this would leave 1,000 deficient in home garrisons, and therefore according to the proportion adopted for purposes of illustration, there should be a reserve of 1,000 engineers.

Now I leave it to Officers of garrison artillery and engineers to say whether my illustration of general principles is an over estimate of the force of artillery and engineers required in this garrison army of known strength. It must be remembered that artillery and engineers can always act as infantry, but infantry cannot act as fully trained artillery or engineer soldiers, and a garrison army without a due proportion of those arms is utterly and perfectly helpless and useless. The balance remaining after deducting these scientific branches from the garrison force, represents infantry and the various contingent

services, and consequently, if 50,000 may be required abroad, of which 22,500 would be artillery and engineers, we must have 27,500 infantry, &c., liable to foreign service. According to this illustration of general principles, the composition of the garrison army would be roughly as follows:—

20,000	Royal Artillery
5,000	Engineers
20,000	Militia Artillery
1,000	Reserve Engineers
27,500	Regular Infantry
26,500	Militia Infantry
<hr/>	
100,000	
20,000	Add further infantry reserve for home service in the event of all the foreign strategic points requiring war garri- sons.
<hr/>	
120,000	

We now come to the "Field Army."

For the occupation of India in time of profound peace, we require 60,000 British troops; such being the case, and for reasons already given in the lectures before referred to, its reserve at the Imperial base, that is at home, must surely equal it. If this be a correct view, we require a field army of 120,000 for this duty. Now no portion of the force necessary for the occupation of India can properly be deemed as always available for the defence of the assailable coast line of the United Kingdom. It is quite possible that at one and the same time we may have to defend India and the United Kingdom. If, therefore, the reserves and reinforcements for India are calculated upon as part of the defending force at home, they would in that case be wanted in two places at the same time. For this reason it appears to me to be a general principle, *that the reserves and reinforcements for the advanced force in India must be considered as supernumerary to the force necessary for the defence of the assailable coast line of the United Kingdom.*

As regards the field army for the defence of that coast line, the first point to be settled is its required strength. There are hardly two people who agree on this subject. Estimates vary from 80,000 to 600,000. I base my calculation on the application of this general principle. *As an enemy's force attacking these Islands would be limited by circumstances connected with sea transport, the numerical strength of our field army of defence may be fixed by reference to the same circumstances, provided its organization and efficiency be not inferior to that of those foreign powers whose geographical position makes even an attack possible.*

Now we must have a Channel Fleet to prevent the reduction of the Imperial citadel by investment; for the same reason we must have fleets abroad. If we do not guard against "investment," it is comparatively useless our taking measures to prevent "capture by

assault," and so long as we have a Channel Fleet, even supposing it to have met with a reverse or to be out-numbered, it may, I think, be fairly assumed that our enemy could not with safety use war fleets for the conveyance of his armies. A combination between Prussia and France against us would most directly threaten our shores. The aggregate steam tonnage of the merchant navies of those powers is only about 138,000 tons. I submit that to apply this total means of steam transport to a purely military purpose, would require much preparation, involving a stoppage of ordinary trade for some months previously. All the large steamers are employed on ocean lines; only about half are at hand at any one time; the smaller steamers and tugs of course are more likely to be always available. For these and many other reasons, which I cannot trespass upon your time to give, I do not see that much more than 70,000 tons of steam transport would be at the disposal of Prussia and France for military purposes at any one time. Taking Captain Tulloch's* estimate as a guide, I assume that every steamer of 1,000 tons can carry 1,500 men, and tow four horse boats across the Channel, and therefore 70,000 tons may be taken to represent conveyance for about 105,000 men of all arms. Supposing our armies to be well organized and efficient in every respect, I conclude that 120,000 is about the present required strength of the field army for the defence of the assailable coast line; I say present required strength, because as the steam merchant navies of Prussia and France are developed, so must our defensive field army be increased.

I submit these considerations to your notice, for it is very important that we should not waste our resources by increasing our purely defensive forces for home purposes out of all proportion to necessity or requirement. By so doing we should be reducing our power of attack, and uselessly maintaining military forces only applicable to a purpose for which they are not wanted. I impress upon you that I am not making dogmatic assertions, I am merely submitting points for your discussion. I am but a student in search of the true solution of the problem, national or rather imperial defence, and in that capacity I lay before you what appears to me to be a general principle.

Assuming my illustration to be correct, the total strength of our field army required for purely defensive purposes would be 240,000, about 60,000 being in India, another 60,000 forming the reserve for India, and 120,000 for the defence of the assailable coast line. But in order to place 240,000 men at any time in the field, allowance must be made for sick, casualties, &c., which I take to be 10 per cent.; therefore to provide for deficiencies so occurring, 240,000 must be added, so as to ensure our field army of 240,000 being always effective.

As regards the constitution of this field army 4 guns per 1,000 may be considered a fair allowance. The war establishment of our field artillery may be taken at 46, all ranks, per gun. According to Colonel Baker, about 20,000 cavalry would be required. With reference to engineers adopting the estimate of Major Bevan Edwards, in his

* See "The Protection of London against an Invading Force landing on the East Coast," Journal, No. LIX.

"Organization for the Army of England," about 4,000 would be the proportion. It is well nigh impossible to make a fair estimate of the number of train and contingent services. According to the Prussian standard, about 14,000 train to 100,000 infantry would, I believe, be the proportion. As, however, one-half of our field army is for India, where the men for this service could best be supplied by natives, if the Prussian standard be applied to that portion of the force for home defence, it may be considered a fair allowance. Under all these circumstances, and for the sake of illustration, we will assume the field army to be composed as follows:—

170,000	Infantry.
31,000	Field Artillery.
20,000	Cavalry.
4,000	Engineers.
15,000	Train.
<hr/>	
240,000	
24,000	{ Add untrained or non-effective all arms.
<hr/>	
264,000	

Remembering the immense amount of instruction and practical experience required in order to make a field artillery, cavalry, engineer, and, I think I may add, train soldier, it is evident that none of these branches, even though intended for home defence, can be furnished by Militia, or by any force not subject to long continuous training. "Time is money;" consequently, to make a man efficient in any of these branches costs a considerable amount. I therefore think that the services of men so trained should be retained, until their efficiency becomes impaired by reason of age. A reference to the evidence before the Recruiting Commission shows that after 14 years soldiers become unfit for cavalry duty, and will "get into any berth in order to get out of riding;" that artillery soldiers are completely worn out after 17 or 18 years, though they may then be considered "fit for the quiet service of garrison relief;" engineers, on the other hand, may be retained with advantage to 21 years. Though there is no evidence as regards train, I think it is likely men in this branch would continue as long effective as engineers. It takes a comparatively short time to make an infantry soldier, and I think I am justified in saying that a man of seven years' service is at his best, and will, with annual training, continue thoroughly efficient, so long as he is physically fit. Now it appears that the system of enlisting for long periods deters men from joining the Army, and that the most effectual method of retaining the services of a man after the expiration of his first period is to offer him increased advantages if he re-engages. If therefore the first period of service be seven years, the private infantry soldier should, as a rule, be discharged with a sufficient retaining fee on completion of his first term, being

liable to be called in for service, and being subject to annual training. The cavalry soldier and artillery soldiery should be induced to remain for seven years more, the engineer and train soldier also. These latter, on completing 14 years' service, should have increased advantages offered to them if they re-engage for a further term of 7 years. But though artillery and cavalry soldiers may cease to be thoroughly efficient at their special work, after 14 years' service they are valuable men, in the quiet service of garrison relief. I therefore propose to recruit the garrison infantry force, liable to foreign service, by re-engaging cavalry and artillery soldiers at 14 years for service in that branch of the forces where they would not actually be required to serve abroad, except in war. It will thus be seen that there would practically be a long service branch of the Army, composed of artillery, cavalry, engineers, and train, the short service branch being the infantry.

I will now complete the outline of the organization of the garrison army.

I propose three great divisions, with fixed head-quarters at Chatham, Portsmouth, and Plymouth. To the 1st I would attach Woolwich and Dover; to the 2nd Portland; to the 3rd Pembroke and Cork harbour. Each division to be under a General of artillery. The regular forces in each would be about 17,000. The garrison districts surrounding these fortified points would in Great Britain furnish 19,000 Militia artillery, the sub-district of Cork 1,000. The 26,500 Militia infantry required in war I would draw from the Irish Militia infantry. The garrison artillery and engineers could be localized. These arms would supply the peace garrisons for Malta and Gibraltar, and I would treat those places as great depôts, posting men in their first period of service to the depôt brigades stationed there in peace, so that garrison artillerymen and engineers would have before them, on the expiration of their first engagement, home service, a fixed position, and permission to marry as a cheap inducement to continue serving.

To each of these great garrison head-quarters would be attached a certain number of the imperial fortresses abroad, of which the garrison divisional head-quarters would be the great feeders as regards *personnel* and *matériel*. By drawing in from their own districts their Militia artillery reserves and the Irish Militia infantry, they could immediately supply the necessary war garrisons for our bases of naval operation throughout the world.

It will now be understood that the Irish garrison sub-district of Cork would furnish 1,000 Militia artillery, the garrison districts and sub-districts in Great Britain, with their local head-quarters at the great fortified points, would provide 19,000 Militia artillery. The rest of the United Kingdom, being divided into field districts, would only furnish Militia infantry. During peace the Irish Militia infantry would be attached to the field army, and in war it would be called in for garrison service at the great home fortresses.

I hold that the artillery and engineers—both field and garrison—the cavalry and train, should ever be maintained at a war strength. It takes two years to make the men of these forces, and, therefore, if the

country will not keep the Army required for its defence always at a war strength, I submit that the expenditure on infantry must be reduced in order to procure the greatest amount of military efficiency with the least possible outlay. If we have a sufficient force of these special arms, we can make ready for war on six months' notice. If we have not a sufficient force of artillery, cavalry, engineers, and train, although we have the infantry, we must wait two years before we can place that infantry in the field.

Now, it appears to me that the only possible way of reducing expenditure on infantry, without sacrificing its numerical strength, is by keeping it in a reserve or dormant state, and this can only be done by "localization and short service." India is the difficulty in the way of short service, while Ireland is the "standing dire discouragement to localization." India is, however, a grand foreign training-school, and the forces under instruction there cost the country nothing. Ireland being poorly cultivated, with great variety of ground in a small area, is valuable as a great home training-school. By looking at India and Ireland in this light a clue may, perhaps, be found to the difficulties they present on approaching the organization of the infantry of the field army.

Supposing it is desirable to have in Great Britain nine field districts, each furnishing 9,000 infantry, that these districts are mapped out, and all the complicated work of distribution done, "the business of organization commences." After deducting the garrison districts furnishing the 19,000 Militia, organized as artillery, there would be at present about 81,000 Militia infantry, or 9,000 in each field district. The computed strength of Regular infantry is 90,000, one-half at home and the other half in India. The term of service for the rank and file is seven years, but the Officers, Non-commissioned Officers, and staff, forming the battalion *cadre*, would be long-service men. The *cadre* in India must be kept full, that at home must either be kept full, or the means must be at hand to fill it at any moment. It is not necessary to relieve the Indian *cadre* bodily and bring it home, because the time of the men filling it has expired. It comes to exactly the same thing, whether the men quit the *cadre* in India or at home. What object would be gained by bringing the permanent *cadre* home to be refilled? Say a battalion, 1,000 rank and file strong, of seven years' men, is raised and starts for India a year afterwards; while out, the casualties by death and invaliding would be about 6 per cent. per annum; vacancies so occurring must be filled up from home; and, consequently, in the last year of service of the men of the regiment there would be only about 640 men whose period had expired. The other 360 would be men in various stages of their term of engagement. Are the *cadre* and 360 men to be brought home merely for the sake of discharging 640 men at home, instead of from India? By such an arrangement some of the 360 would spend their whole service abroad on board the transport, for their engagement would expire before the *cadre* could again move back to India. It is evident that were the seven years' scheme adopted, a different system from that existing now must be introduced.

I therefore propose that each regiment consist of two battalions, the *cadre* of the 2nd being placed in India, the other being fixed in a particular locality in Great Britain. The Officers and Non-commissioned Officers to be posted to and relieved from the 2nd battalion in rotation, by regimental arrangement, the period of service in the 2nd battalion being fixed. The 90,000 infantry would thus be organized in 45 regiments of two battalions each. This would give five regiments, or 5,000 regular infantry to each field district in Great Britain, and, consequently, five permanent regimental head-quarters. To each of these one-fifth of the Militia in the district would be attached, or about 1,800, two battalions 900 strong.

As regards Ireland, which I propose to treat as the great preliminary training-school for India, 24,000 is the number required to balance casualties in the "field army;" of this the proportion of infantry would be 17,000. Deducting the Foot Guards, which is and must ever be a special service, we have about 11,000 remaining to form a great Irish *depôt*. I would divide Ireland into the same number of field districts as Great Britain, the head-quarters of each being chosen for "strategic reasons." Each division of Great Britain would thus have its divisional *depôt*, about 1,250 strong, in Ireland, thus establishing a local connection between the divisional districts in Great Britain and those in Ireland. Each of the 45 regiments would have in Ireland about 250, with an Irish *depôt cadre*.

So far, then, each regiment would consist of 2,250 all ranks, of which 1,000 would be in India completing training, 250 in Ireland undergoing training, and 1,000 in reserve at its fixed regimental head-quarters in Great Britain. As an efficient force must ever be maintained in Ireland, recruits raised in Great Britain should be able to take their place in the ranks before they join the Irish *depôts*; therefore such recruits would receive their first instruction at their permanent regimental head-quarters. A man joining an infantry regiment would commence his instruction at its head-quarters or its *depôt*; if he were an English or Scotch recruit he would, after about three months, pass to Ireland, and thence in about one year afterwards to India, returning home at the expiration of his seven years' service. I would offer £10 a year, including training pay to that man, on condition that he joined the 1st battalion, underwent an annual training, and was liable to foreign service if required. The rank and file of the whole of the first battalions would thus be in reserve, and the cost of their maintenance would be about £410,000 a year added to the charge for their food during training, which I would not deduct from them. Under the proposed arrangement, in Great Britain, there would be no rank and file of the infantry of the *field army* in an active state, save the Guards, about 11,000 in Ireland, and a certain number of Regular and Militia recruits under instruction, and casualty men awaiting discharge. The battalion and *depôt cadres* should, however, be always kept complete. The period of service with the 1st battalion should be regulated, so as to make the number annually passing into its ranks correspond with its average casualties, thus ensuring the ranks always

being kept full. After a man had completed the regulated period in the 1st reserve, he should be induced to re-engage for a further term in a 2nd reserve, the period of training being reduced, and the retaining fee being also reduced, he should be liable to foreign service, and not be discharged until he becomes unfit for active service by reason of age or infirmity, when he should receive a small pension calculated by his total service. The strength of this 2nd reserve cannot be calculated unless the term of service in the 1st battalion be fixed. Without more accurate information it is impossible to do so. Supposing it to be 30,000, at £5 per man a year, the total pay charge for 71,000 rank and file in reserve, and 11,000 active infantry in Ireland, would be about £800,000 a year. Under the existing system of keeping all our infantry in an active state, I calculate a similar force of *rank and file* would cost upwards of £1,800,000 per annum. Each regiment would thus have a 3rd battalion of, say 650. The *cadre* should be kept complete, and, therefore, the 3rd reserve and the Irish depôt would require a battalion *cadre*. There would be three to each regiment, two only on the British establishment. The Non-commissioned Officers of the two Militia battalions would be permanently employed doing duty with the Non-commissioned Officers of the 1st and 3rd battalions during non-training periods. There would be a standing force in the United Kingdom of infantry non-commissioned Officers numbering in the aggregate about 15,000; they would be the picked men of the Army. These should be well paid, and receive good substantial pensions when physically disabled.

As regards cavalry: About 1,200 are Life and Horse Guards; the cavalry of the Line would consequently be about 18,800, or 30 regiments of an average strength of about 625; of these 8 would be serving in India in a somewhat reduced strength, 22 at home, say 4 in Ireland, and 2 in each divisional district in Great Britain. These regiments might be constantly changed, as at present; they would be composed of men whose inducements to serve increased up to 14 years, after which provision is made for allowing them to complete their time in a quieter branch of the Army. The cavalry stations being permanent, each might have a depôt of deserving men, in their second period of service, for ordinary barrack duties. In this way might the number of horses be reduced in proportion to the number of men allowed to remain stationary. These depôts would be attached to each regiment taking up its quarters at the station, the horses of which would furnish the means of keeping the men up to their work. The cavalry should not be restricted to any particular districts; Ireland would be probably its best recruiting ground, and a greater number of these regiments might have Irish names.

As regards field artillery: The brigade of Guards ought not to be without its proportion, 1,000, leaving 30,000 for Line service. There would be about 70 batteries in India at a reduced strength, and the field artillery force at home, taking Royal Horse Artillery and Royal Artillery together, would furnish about 78 batteries at a war strength, say 15 in Ireland and 7 in each field district in Great Britain. I must

here remark that, as I am only dealing with general principles, my figures must be regarded as mere illustrations and nothing more. Each field artillery station in the United Kingdom would be permanent. As with the cavalry, so with the field artillery. I would form depôts of deserving men in the second period of service; the strength of each depôt to be equal to the difference between the peace and war establishment of the batteries accommodated, and at these stations with those depôts I would place the additional war equipment as regards carriages, &c., so that, though the field batteries would move about the country at a peace establishment, in their barracks would be everything required to enable them to take the field, except the horses for the second Line.

As regards engineers: No men of this force are, it appears, required in India. The proportion for the brigade of Guards would be 100. Allowing 300 to Ireland, there would be 400 in each field district in Great Britain. 375 would be about the proportion of train to complete the the Guards brigade: there would be about 1,000 in Ireland, and 1,500 in each field district. These two branches of the field army could be localized, they would only be liable to service abroad in war. In peace the cost of their maintenance, between the periods of military training, would be considerably reduced by employing them in the military manufactories and supply departments in their districts.

Of the 24,000, or 10 per cent., allowed for casualties in the field army, 17,000 infantry has been accounted for; the proportion of the other arms would be 3,100 artillery, 2,000 cavalry, 400 engineers, and 1,500 train; these would be at the various depôts and schools of instruction. Thus the riding establishment, engineering school, and all staff and contingent services would be amply provided for.

The general distribution of the field army would be as follows:—

Great Britain, 9 divisions, 23,000	207,000
Brigade of Guards, all arms	8,500
Ireland, 9 depôt districts, regular troops	18,500
Forces in India.....	60,000
	<hr/>
	294,000

This 30,000 infantry, more than the estimated *defensive* strength required, represents the possibility of increasing, at comparatively small cost, the offensive power of our field army. The machinery proposed is, I think, adapted to both a voluntary or a compulsory system, to the maintenance of an efficient Army of defence, and to the creation of an Army of attack. Year by year wages are increasing, while the parsimonious tendency of the nation as regards military establishments in peace, is also increasing. This being the case, it is only by making such arrangements as will least interfere with soldiers following civil occupations in peace that the Army can, with any prospect of success, compete in the labour-market for men.

In conclusion, I desire to draw attention to the impossibility of arranging the territorial boundaries of military districts by counties or

by any ancient custom. In my former papers I did this for purposes of illustration, but undoubtedly the district limits can only be defined by reference to the distribution of populations. It appears to me that reorganization, based on the county system and the existing regimental system, will not be desirable, because these two conditions are irreconcilable.

I hope this rough outline will be understood. I have compressed the contents of 140 pages of the first two parts of my general plan of Imperial Defence* into this paper of 13 pages; this will account for many shortcomings and deficiencies. I now submit these general principles to your consideration, with an apology for the imperfect manner in which they are laid before you.

Captain WHEATLEY, R.N.: We all greatly admire the plan which Captain Colomb has just explained to us. I consider that the last six months have been one of the crises of this country, and I merely wish to show the necessity for adopting some plan similar to Captain Colomb's. Prussia and Russia are now in close alliance. Prussia has acquired immense wealth as the result of her late war with France. Both nations have large fleets—fleets, taken together, about equal to our own. Many Englishmen rely upon our fleet as our first line of defence. We have been spending about £12,000,000 upon the Navy in order to find out what we ought not to do, but I do not say this in the way of finding fault, because it is an almost necessary expenditure. The ship must be designed after the gun—the gun has outrun the ship.

Captain Colomb says that military organization depends upon naval organization; and what I wish to do is to show the necessity for Captain Colomb's, or something like his principles, being brought into play, because so many rely upon our first line of defence, our Navy. In the present crude state of ships—with foreign nations as well as our own—a naval action must be very much a matter of chance. It may result, like the naval action between the first "Monitor" and the "Merrimac," in a drawn battle; or the first shot that takes effect may decide the battle; we cannot tell one way or the other with the ships we have, or that other nations have. Our forefathers left us a name for honour, weight, and power among the nations of the world. I think it is our duty to convey to our descendants that name untarnished in honour, undiminished in power and weight. I think, therefore, that unless some alteration is made in our present system, and something of the character of Captain Colomb's plan be adopted, that we may soon have to pronounce the awfully terrific words for any nation—"Too late!"

Captain HOSEASON, R.N.: It is with much pleasure that I rise to thank Captain Colomb for the very able paper that he has read before this Institution. I perfectly agree with him in all the leading points that he has advanced in favour of considering the British Empire as a whole. We must never lose sight of the fact, that we possess that which other nations do not possess, viz., an enormous Colonial Empire, and an immense amount of floating wealth. We cannot, therefore, limit our plan of operations merely to a defence of our shores. We must always regard the British Empire as a whole, and consider not merely how we can defend our Colonies, but how our Colonial possessions can be made to aid in the defence of our vast floating wealth. We possess about 46 Colonial possessions, including our Empire of India, containing in all about 220 millions of inhabitants. The population of Great Britain alone being about 31 millions, is nearly equal to the entire German Empire, and nearly double that of the Prussian Kingdom before the late Austrian war, for the population of Prussia was only 18 millions before the year 1866. This country possesses moreover every element of military strength in far greater proportion than

* "Imperial Defence." Part I, Imperial Strategy; Part II, The Reorganization of Our Military Forces.

any other country. All that is needed is *organization*. We have only to consider what are the requisites for carrying on warfare, to perceive our own superiority—they are men, money, coal, labour-saving machinery and munitions of war. Let us but recognize the fact that 1 lb. of coal effectively used in a high-pressure condensing-engine equals the work done by an able-bodied man in 24 hours, consequently steam machinery as applied so generally in Great Britain in aid of our population in our manufactories and elsewhere, has been estimated to equal the work annually of 100 millions of men. This is totally irrespective of the saving of labour by the use of those mechanical implements now so universal, that are not moved by steam; therefore the economy in manual labour in this country since 1815 is incalculable. The floating wealth of this nation as represented by the imports and exports, amounts at the present moment to 530 millions sterling, irrespective of the value of the ships themselves, and also totally irrespective of all specie imports, which I have no correct means of ascertaining. The *realized* capital in this country can hardly be estimated, so great has been its accumulation since 1815, but it must be counted at thousands of millions. In the last sixteen years alone, or since the Crimean War, the value of our imports and exports per head of population has nearly doubled, for in round numbers they stand as £9 per head to £18. The importance of a general plan of offensive and defensive operations as submitted in Captain Colomb's paper, will be still more apparent when we observe that he proposes to strengthen our military depôts in various quarters of the globe, and thus keep open our great highways of commerce, for we must never lose sight of the fact that the enormous expansion of our trade and the increase of population has made us greatly dependent on foreign countries for *our imports of food*. The nation has again been seized with one of its periodical fits of panic. The position that France has been reduced to in a few short months, has astonished those who would not read the signs of the times aright. For my part, when I read my paper in this Institution in May last, I was firmly convinced that a war between France and Prussia might be expected at any moment, and I trust now that we have been so rudely awakened to a sense of insecurity, that the country will take an enlarged view of this great question, as will be found so ably treated in the paper we are called upon this night to discuss. An efficient organization, however, such as has been so completely carried out in Prussia, is a plant of slow growth, but it would never have arrived at its present perfection had not a sound system been originally sketched out and persistently followed. It is therefore imperative that we should fully recognize the fact that this country is *an island*, and not part of a continent like Prussia, and that therefore our plans ought to be matured in conformity to our peculiar position. One point of the Prussian system must strike the most superficial observer, viz., the rapidity and facility with which its army can pass from defensive to offensive operations. Had not Prussia so matured her organization, her financial resources would never have supported the charge consequent on calling out so vast a body of men under arms.

General LEFROY, R.A.: I think that we are under obligations to Captain Colomb for having distinctly brought before us and before the public, not only on this occasion but on several other occasions, that we are not as a great empire to shrink into our shell, and to consider that the imperial interests of Britain are bounded by the four seas of England. He has laid that down with great strength and clearness. I entirely and cordially concur with him, as I also do with the remarks which have fallen from Captain Hoseason. But I confess that I have read this paper and listened to it with something of the feelings with which one regards a magnificent design for a palace that is proposed without much regard to architectural difficulties or financial considerations. It seems to me that a scheme so logical and symmetrical is an illusion, at least if we regard the political organization of the British Parliament and the possibility of its realisation. If we cannot defend ourselves short of having a garrison Army of 240,000 trained soldiers always on foot, which I presume supposes them complete in all the accessories of an army; and a field Army also counted by hundreds of thousands in addition, then I fear we must remain in our present powerless state. I do not entirely agree with Captain Colomb in thinking that the British *forces* should be withdrawn from the remoter parts of the empire. I recollect, as everybody else does, that when the Roman eagles turned their wings homewards, the

Roman provinces soon ceased to be Roman provinces. And I believe if England withdraws her troops from her distant possessions, they will soon cease to add to the dignity, the pride, or the power of this empire. I entirely dissent from the notion that we can safely withdraw our troops from our distant possessions, on the assumption that we can again launch them forth at short notice wherever they may be required. We shall assuredly be disappointed if we ever act upon that idea. And why should we deprive our Army of that large experience, that acclimatization, which makes a body of British military men in many respects different from any other military body in the world? An intelligent Officer of almost any foreign army invited to a British mess and conversing with those around him, is struck by the peculiarity and the value of that experience of distant countries which they have acquired and display easily and without pretension. I have heard it often remarked, and for my own part shall be extremely sorry to see the policy adopted which seems to be now gaining the public ear, of leaving to local militia, in countries where labour is so highly paid that we know very well what a local militia generally becomes, the custody and guardianship of interests which are not only our property but the inheritance of our children, of territories which are not only ours but theirs. I cannot see the wisdom of concentrating our Army at home, subject to the caprices of Parliament or to the exigencies of party. With the system which we know *has gone on* for the last thirty years and will go on for a long time to come, these capricious hot fits and cold fits, which affect the defences of the country; what, I should like to know, would become of the 240,000 men of the garrison Army by-and-by when a severe re-action takes place and we begin to cut down again? I like that conception of Webster's, a poetic image often quoted, where he speaks of the roll of our morning drum encircling the globe. The roll of our morning drum should encircle the globe while Providence commits to our care so great a portion of it as at present. But if, on the ground of financial difficulty, we leave these things to take their chance, trust to the forbearance of other Powers, deluding ourselves into the belief that their ambition is going to slumber, forget how during the last two generations these nations have been working up more and more to a level with us on all those points in which our superiority existed at the beginning of the present century; I say, if we act upon that principle long, we shall find ourselves where Holland, Venice, and other States of small extent and once great energy at last found themselves, when selfishness and corruption had done their work, when they had "but a name to live, but were dead."

Captain P. H. COLOMB, R.N.: I should like to ask the lecturer to correct the misapprehension into which I think General Lefroy has fallen. I have no knowledge of the paper except from hearing it read, but I have not in the slightest degree understood that the English eagles are to be withdrawn from our colonies as the Roman eagles were withdrawn from theirs. I have understood the contrary; that it is the lecturer's intention to make the English eagles stronger at present in our colonies; only, as I think I understood him, not in a military form. I think his idea is, that looking to those political accidents which General Lefroy very properly alluded to, he has made it clear to his own mind that we will not in time of peace keep anything like a military force in any colony which would be incapable of protecting it during war. I think his idea is, that we should mislead the colonies by keeping up a force in peace which we might probably withdraw during war; at any rate, we should lead them to rely upon a force which is not really capable of defending them. I understand his idea of concentrating the forces in England to be, that we should be prepared to let loose those forces for the defence of the colonies in time of war, and that we are to keep up the strongest and closest connection with them, and to let foreign nations know that we do keep up this close connection by the presence of a large naval force. I think that to be the view of the lecturer, and I have merely risen to correct what I thought a misapprehension.

Captain HOSBASON: I have only to observe, that had not that been my conception of Captain Colomb's paper I should have arisen to oppose his views. But I imagine that he meant the great pivots of operation to be maintained by the Armies of England; that it was only on the different selections that he grounded his plan, and not on the abandonment of the colonies by English troops.

The CHAIRMAN: I think I can explain the discrepancy. Captain Colomb has condensed his lecture; I have read his book, and that part which relates to the defence of the colonies had been delineated.

Captain J. C. R. COLOMB: I can only say that it is so. I would withdraw the troops from certain of our colonies and have strategic stations thoroughly protected by naval forces in time of peace. I say that there are certain imperial strategical points which we are bound to hold against all nations. I would defend the empire by the concentration of force at those points which are necessary to the safety of the imperial roads.

Colonel JERVOIS, R.E.: Captain Hoseason has in a great measure forestalled me in what I intended to say. I agree generally in the views expressed by him, and in those of Captain Colomb, as regards looking at the defence of the United Kingdom from an imperial, and not merely from a local point of view. I may remark with respect to the observations of my friend, General Lefroy, that whilst he is of opinion that Captain Colomb has suggested the building of a palace without reference to expense, he himself proposes to build a whole city of palaces, regardless of the cost. Whilst Captain Colomb suggested a general scheme which might be reduced or expanded in proportion as the funds at the disposal of Government would permit, the scheme of providing imperial garrisons of sufficient strength to be of any use in the Australian, the Canadian, the South African, or the West Indian colonies, and in the many other colonial possessions of Great Britain, would, I venture to think, if you will take up a sheet of paper and calculate the cost, be found impracticable. A small imperial force in Canada would only be a temptation to our neighbours to attack us. If you leave a force in Australia, you only do work that the Australians can very well do themselves, and which they will probably do a great deal better if you leave their internal defence to themselves. I venture to think also that the presence of a British force on the Cape frontier is a temptation to the colonists to indulge in Kaffir wars, which have, I am told, been a source of commercial advantage to many of them. The true policy of this country in regard to its defence, is, first and foremost, a great naval policy. As both the lecturer and Captain Hoseason have remarked, our ships must command the communications of our merchant ships during war, and in order that those ships may have bases of operations for coaling, for refitting, and for shelter; places such as Simon's Bay, at the Cape, Port Louis, at the Mauritius, Trincomalee or Galle, at Ceylon, Hong Kong, Bermuda, Halifax, Gibraltar, Malta, must be maintained as naval stations, and these places must be made strong in themselves. They must not be dependent upon our fleets to protect them. They are the bases of operations that must be defended during the absence of the Fleet, so that when ships repair to them to coal, and to be supplied with provisions and to refit, they may find the coal there, they may find the means of refitting there, and they may find the means of shelter there, while they are refitting. Such are the objects of these places. These naval stations should certainly be garrisoned by imperial forces. This, however, is a very different matter from the garrisoning of colonial possessions which are not required for the support of our fleets. It is a question of arrangement whether the naval stations should be garrisoned by purely military forces, *i.e.*, by troops of the Line, or by marines, or by sailors landed for the purpose. As between marines and troops of the Line, it is a matter for consideration between the Admiralty and the War Office, and probably it is of no great consequence under which Department the garrisons for our naval stations are maintained. There might perhaps be certain advantages in placing them under Admiralty jurisdiction. I only rose, however, to give my adhesion to the general principles of the lecturer, for I have not gone into his details sufficiently to be able to form an opinion upon them. But whatever conclusions may be arrived at respecting the details of his proposals, I am sure we must all agree that it is very cheering to hear the question of our naval and military defences treated in the comprehensive manner in which they have been regarded by Captain Colomb.

General LEFROY: My friend Colonel Jervois put a word into my mouth that I did not use; I said nothing about great forces in the colonies, what I said was that the British scarlet ought to be there, I do not care how small the force may be. I do

not say that 70,000 men should be in Canada, but I do say that the British ensign should be there, if it is only a corporal's guard, and I would rather have that corporal's guard there, if war broke out in America, than have only colonial troops.

Colonel EVELYN: In the very interesting speeches that have been delivered this evening, I have been somewhat surprised at not hearing more about the details of Army organization. I take it that the general principles of military organization should consist of keeping your troops, when on peace establishments, always fit for the reception of an enormous accession to their numbers when put on a war footing. I think that is the main thing—that your army on a peace footing should be of moderate strength, but should be fitted for the reception of vast access of numbers in time of war. We should certainly learn from our neighbours when we can, and it is observable in the late war that the Prussians did not raise a new battalion, or a single new battery or squadron, when they went to war. They had the cadre of everything ready, they had only to recall their old soldiers to their colours, and their army was at once on a war footing. What should we do if we had to take the field with 150,000 men in Belgium or elsewhere? We should have to raise new regiments, with Officers and men knowing nothing of each other, in fact, we should have to reorganize our Army. We have at present no organization for the reception of the men even if we had adequate reserves. Though it is true that young soldiers fight extremely well, I think it is doubtful whether a new regiment fights as well as an old one. If you have an old regiment, with *esprit de corps*, and historical associations, I think you may infuse into its ranks a number of recruits, without diminishing its efficiency. But if you form your recruits into new battalions, you do not get a force that can be depended upon. Now the Prussians have shown us that large companies are not an inconvenience on service. They have companies of 250 rank and file, and have shown us that that is a good and useful number in an European campaign. If that is the case, we have at once a simple means of changing at any time our infantry from a peace to a war footing by raising the companies from their present small strength up to 200, and 250 rank and file each. If that be possible, we could with our present organization increase our force four or five fold, and put them on a war footing without raising a single new regiment, though this would, of course, necessitate the division of our present regiments into two or three battalions. The same principle might be applied in a great degree to the cavalry and artillery, though those special arms ought certainly to be kept on a much fuller strength than infantry, because they take much longer to prepare. I understood Captain Colomb to recommend that the Militia, particularly the Artillery Militia, should be out for a year. (Captain COLOMB: That in every case the Militia should have a year's training when first embodied.) I hope in the course of two or three years that the Militia will be embodied; but it is the fact that at this moment the Militia could not be embodied; it is not in the power of the Government to embody the Militia, unless we are in a state of war. It is a great pity that the terms of a militiaman's service are not simplified. There has always been some extraordinary restriction introduced into the Act under which he serves. It has led to all sorts of misunderstandings, almost to a mutiny. When I first belonged to the Militia, the men were only bound to serve when the country was in "imminent danger of invasion," not during any war; but the men were then called on to serve during the Crimean war when there was no danger of invasion, and they were embodied under a fresh Act. But the men who had been previously enrolled under the old Act said, "We won't stay; we are only liable to be embodied in case of imminent danger of invasion, and you call us out now when there is no danger of invasion." The Militia was really reduced to a state that was dreadful. It was for a time only fit for disbandment. The regiment to which I belonged behaved, comparatively speaking, particularly well; that is to say, not more than one-third of the men refused to come to parade. I leave you to guess how some other regiments behaved. Well, the Government had to give way, because the men were in the right, and Government had to let any militiaman who liked, have his discharge, and those who were willing to remain were re-attested under the new Act, and received a new bounty. The Act which was in force when most of the men now serving in the Militia were enrolled, does not

render them liable to permanent service except when this country is at war ; so that, unless we are at war with somebody, we cannot embody the greater portion of the men who now form the Militia ; it is only the men who have been enlisted since the 9th of August last, which is the date of the new Act, who are now liable to be called out for embodied service. There is still a stipulation in the present Act which may be the ground of future complications. It is that they could be only be called out on a "great emergency," whatever that may mean. Whatever a "great emergency" may mean, it can hardly mean the normal state of affairs. Now, as Captain Colomb thinks, and a great many other good judges think, that a certain portion of the Militia should always be embodied, it is a question whether the men would not say, "Oh no, we only engaged to serve in a great emergency, how can you call us out to serve when there is no emergency in particular." So it is to be hoped that there will be another Militia Act brought in, in which the words "great emergency" will be left out, and that the Secretary of State for War will have the power to call out the Militia whenever he thinks it necessary. He should be the responsible man ; it should depend upon him, and not upon the militiaman to say whether the force should be called out or not.

Lieutenant Colonel LEAHY, R.E. : I beg to add my testimony to the value of the paper that has been read, and to the able manner in which Captain Colomb has recapitulated the principles which ought to be borne in mind by all those who consider our military and naval reorganization. He has very properly pointed out that the two subjects cannot be considered separately, and I am much inclined to think that the naval and military organization of this country will not be put on a proper footing until there is one War Minister, who shall direct the policy both of the Admiralty and the War Office. Of course, to enable an individual to do this, it would be necessary that he should be relieved from the administrative details of those departments, and from the responsibility which now devolves on the Secretary of State for War, and on the First Lord of the Admiralty respectively, in respect of decisions on technical questions. Such a course, if it should ever be adopted, would enable the heads of the naval and military departments to be taken more frequently from Officers of distinction in their respective services, whose opinions would be regarded with confidence by the country and the services.

I take this opportunity of observing, with reference to what the lecturer and Captain Hoseason have said, that I do not think the country or the Parliament can be accused of parsimony in dealing with the naval and military services. I believe if they had greater confidence in the administration, that there would be no lack of funds to carry out the necessary reforms. Captain Hoseason told us that there are five hundred millions of trade annually afloat on the seas. It is equally true that we pay for our naval and military services at home and in India a sum approaching £40,000,000 a year. Now, 8 per cent. is not a *low* rate of insurance. I believe that the money now spent would, if administered to the greatest advantage, produce a naval and military force that England need not be ashamed of.

With very slight qualifications I am prepared to endorse the general principles that Captain Colomb has laid down. I think it is a question whether the colonial stations enumerated in his previous lecture,—with the single exception of Bermuda, which I think ought to be placed on the same footing as Gibraltar and Malta,—should not be looked upon as naval stations. I have long advocated that the infantry garrisons of those stations should be taken from the Royal Marines. As regards Canada and Australia, when I first wrote on this question, I submitted for consideration that it was desirable that weak second battalions or *cadres* should be kept in those colonies, to be filled up in time of war by men who had passed through the ranks of the regular Army, and who had settled in the colonies. I believe in that way the outflow from emigration, which is stated to be one of the obstacles to recruiting, might be made the means of filling the ranks of our army in our colonies in time of war, and of attaching to the British colonies a desirable class of settlers. It would be a gain to our military forces if a large proportion of men, all trained soldiers, of from 3 to 21 years' service, could be induced to settle in the colonies, with the liability to join a battalion in that colony. We should thereby meet General Lefroy's point of flying of our flag in the colonies, and at the same time adding to

our military forces at little expense to the Imperial Government. With that single qualification I am prepared to endorse the general principles of colonial defence that Captain Colomb has so ably laid down.

I shall now pass to some of the details that he has indicated. With regard to the details of the service with which he is more particularly cognizant,—the artillery service, I have little to say. I think he has taken right ground in proposing that the artillery corps should have permanent head-quarters. I would beg the meeting to bear in mind that there is a great distinction between "permanent head-quarters" and "localization." I think, however, that the number of permanent head-quarters he has indicated for the artillery is rather limited. In addition to Chatham, Portsmouth, and Plymouth, I think there are other stations throughout the country, for example, the Mersey, the Humber, the Tyne, the Firth of Forth, and Harwich, at which opportunities could be afforded for training artillerymen in the management of heavy guns. Considering that the artillery service is that to which our localized Militia and Volunteer forces can in many cases be most advantageously trained, I think it would be desirable to have a larger number of artillery head-quarters.

The next point that Captain Colomb touched upon is short service. There I venture to say that he has misapprehended the term. "Short service," to my mind, should be designated the period of service required to train and discipline a soldier. This period has been laid down by the highest military authority as three years for an infantry soldier. It is the period for which the Prussian Government so long and so stoutly stood out. It is the period of service by which—as I gather from his speech in the House of Lords—the Duke of Cambridge is prepared to abide. I therefore define "short service" for an ordinary soldier to be three years. In the case of men of superior educational qualifications, the period of service is reduced in Prussia to one year, and the same rule might possibly obtain in this country. Any attempt to combine efficiency of the regular Army with a shorter period of service will in my opinion lead to failure. I maintain that service in India should be an entirely separate engagement from the short service of our soldiers at home. Irrespective of other considerations, it is one of the distinct recommendations of the Royal Commission on Recruiting that no soldier should be sent out to India until he is seasoned, and they lay down two years for the period of seasoning. My proposal conforms to that view. It is understood that the Indian Government has remonstrated against the class of recruits that have lately been sent out to India, one consequence being that the death rate among the troops of India has increased by, I believe, 1 per cent. I therefore maintain that it is desirable that none but seasoned soldiers should be sent to India. I think also that an attempt to extend short service to seven years would fail, because if we were to take men for so long a period from their industrial employments, we should not get a sufficient supply of recruits to carry out to the full intent the principle of "short service." I think it will also be attended with failure if we throw back on the civil population, without pay or pension, men who have served eight or ten years in the regular Army, a part of the service being in India. I think the true principle upon which to get recruits is to send back every man who has served his full time in the army, a contented man, and then he will find two men ready to come in his place. With a proper application of the "short service" principle, probably a three years' service, and taking the Government estimate of recruits, namely 32,000 a year, we should be able to remit into the Reserve 23,000 trained soldiers a year; and in that way we should very soon get an efficient Reserve, and a large proportion of our Militia force would ere long consist of men who had served three years in the Army. With regard to the figures of Captain Colomb, they agree very nearly with those that I submitted for discussion within the last few weeks. I calculated the field Army in England, including the Militia, at 250,000 men, and the garrison Army at 120,000, of which a small proportion only would be under the colours.

The next point I notice in his paper is that he adopts the double battalion organization, which I always advocated. I believe this to be a detail necessary for the successful application of the short service principle to our existing regimental organization.

I must, however, entirely dissent from Captain Colomb's mode of raising and local-

izing regiments. I first took up the question of Army organization, consequent on a conversation with Sir John Burgoyne, in which he said that he would like to see the short service principle applied without breaking up our old established regiments. Acting upon that suggestion, I endeavoured to work out a plan such as would admit of the application of short service to our regimental system, and maintain our long established regiments; and I submit that I do not believe localization is necessary.

The Royal Commission on Recruiting say that it is neither "desirable" nor "expedient" for our regular forces. Localization is a necessary detail of the Prussian principle, because conscription is part of their system, and localization is introduced to lessen the tax of enforced personal service. Where there is no conscription, localization is not necessary. The proposal to localize the infantry gives rise to difficulties, especially the Irish difficulty, which I think it is unnecessary to create. I think Captain Colomb's proposal to garrison Ireland by detachments from English and Scotch regiments and to remove the Irish Militia from Ireland, for garrison duty to England in time of war, is a scheme that will not commend itself to military men or to statesmen, and I am sure it would not be favourably received in Ireland.

I am, however, glad that Captain Colomb has acknowledged this difficulty, and proposed a remedy, thus giving an opportunity of stating objections to his proposals.

Captain MONCRIEFF: After the very able paper that has been read, and valuable remarks that have been made, on this subject, I am reluctant to say anything; but I should like to notice the views of the last speaker, and also a statement which fell from Colonel Evelyn. At the beginning of his remarks I was inclined to differ from him, because he wished to bring the subject back to matters of detail. I think we should feel very much indebted to Captain Colomb for having lifted this question out of the inextricable details with which it has been surrounded. I have no doubt that at this moment they are in another place (the House of Commons) even more seriously embarrassed with these details than we are here. I believe that this subject, in its present state, is much more likely to receive successful treatment, if dealt with first on general principles, as Captain Colomb has treated it to-night. He deals with matters which are of vital and imperial importance, necessarily embracing the whole British possessions within their scope. I myself believe that a great deal of the embarrassment which has arisen lately has been due to the action taken by a class of politicians who say that their motive is peace—that they must have peace at any price. But I fear that they are the most warlike people we have in this country, because they shut their eyes to facts, and if their policy is pursued, it will inevitably lead to aggression on the part of ambitious and warlike neighbours against our wealth and commercial system. It is a maxim in war, that the side which takes the offensive can always conduct operations with smaller numbers, and at smaller expense and suffering to its own people than the side which remains upon the defensive. We have seen this illustrated in the late war. Our forefathers did not tolerate a fallacy that affects to some extent modern English opinion; their maxim was, that England should always fight her battles on another soil. And I think the reasons for continuing this policy are greater, and stronger, now than ever existed before. The same laws which apply to strategy in war perhaps apply also with even greater force to the policy of nations. If England allows herself to drift into juxtaposition with any powerful and aggressive military state, which can also command naval resources, we shall then certainly have to maintain much larger armaments at much greater expense than we do at present. With our great colonial possessions and commercial relations, I believe the only way in which we can command security at a reasonable expense, is to carry out on broad principles a well-organised scheme of combined naval and military defence, such as that which has been sketched out by Captain Colomb. With regard to some remarks from Colonel Evelyn as to the state of the Militia, and bringing us back to details, there is one point, in my opinion, of the greatest importance, namely, that the Militia of this country is kept in a most unsatisfactory state; it is hampered in such a way that the men really do not know what their position is, whether, in fact, they are soldiers or not soldiers. I confess I was very much surprised to hear the account given by Colonel Evelyn of

his own regiment, and protest against the deduction he drew against others. My experience in the Militia extends back to 1855.

Colonel EVELYN: What time in 1855?

Captain MONCRIEFF: I got my commission early in 1855, but was for some time with the British Army in the Crimea as a Militia Officer, and therefore did not join the regiment at once. I believe that the Militia, as a rule, if they are properly treated, would be as ready to go to the front, either for defensive or offensive operations, as any portion of Her Majesty's forces. But they must be properly treated; they must be treated as soldiers; and if so, I believe they will respond to that treatment, and may be thoroughly relied on. I hope in future that if the Militia is to be calculated upon as an integral part of the military force of this country, that the fashion of draining that force to feed another one should be given up; and that when the Militia is called upon to act, it should be permitted to do so as battalions, not as individuals. We know very well that the great majority of the regiments of the Line were once Militia regiments; they have been taken into the Line in time of war, and have not been returned again. If any contingency should arise in which this country is vitally threatened by a powerful enemy, we cannot expect to have a sufficient reserve of the regular Army, however much is done to create one; we must fall back upon the Militia, as has always been the case in serious need. The Militia should, therefore, be put in a position to have a portion of its force always thoroughly trained, as well as the Line, and ready to take the field. When once England puts half-a-dozen Militia regiments on the Continent, she by that single act makes herself a first-class military power; because its numbers are inexhaustible, and I am confident of this, that if one regiment volunteered to join the regular Army in the field, every regiment that had been embodied long enough to acquire a proper *esprit de corps* would be ambitious to do so also, and to have the same honours upon its colours. I cannot help thinking that our statesmen have not used sufficiently that old constitutional force. They do not require to copy other systems to get security. If they will only treat the Militia in a proper way, I believe we should be able to meet a great many of the military requirements of the country, and obtain at a small expense the security we desire. There is no purchase question, or anything of that kind, to obstruct the path of reform and reorganization for this force; it is merely that our rulers cannot see the nature of the magnificent engine at their disposal, which has only to be put in proper gear to enforce, along with the Navy and first Line, the decisions of, or repel outrages on, the British race. I hope to see the day when the Militia will be more acknowledged as an important part of our military system, and when it is, I can confidently predict that it will be ready to meet any requirements from it demanded.

The CHAIRMAN: Captain Colomb, will you now reply to the observations which have been made?

Captain J. R. COLOMB: First of all, with reference to General Lefroy's remarks, they have been a good deal corrected by Colonel Jervois. In bringing this subject before you, I could only deal chiefly with the defence of the Imperial bases. But if you look back to my papers, you will find that the principle upon which I rest the whole system, is the defence of the Empire, including the colonies. And I say you must apply to the Empire as a whole, the same principle which you would apply to any country. You must command your communications, and instead of scattering forces all over the country, I place forces at the cross-roads, in point of fact; and thus by strategy make good the deficiency of numerical forces. With regard to the British scarlet, I quite agree with General Lefroy; but I say I would let the British scarlet be worn by the men who have the more direct interest in the defence of the colonies. They are the people of the colonies. I would give them every facility with regard to experienced Officers and military equipment; but the scarlet should be worn, I consider, upon the backs of the population who are most interested in the direct defence. My general principle is this, that those colonies whose position is not such as to render them of great value as military posts to the Empire, must defend themselves; and those colonies which are necessary to the Empire as military posts we must strain every nerve to hold. It will therefore be easily understood that when General Lefroy implied that I

meant to withdraw military forces from the colonies for financial reasons, it is purely on military grounds that I would do so. With regard to the marine garrisons, I wish to correct an impression conveyed by one remark of Colonel Jervois. The *marine* garrison is to my mind of great importance, for this reason, to secure communications you will require a very large fleet, a fleet that you will not likely have in peace; and I think if you have your marine garrisons or naval forces at your naval head-quarters, and if you have that naval force in reserve ashore, and the ships in reserve, you can at any moment expand your forces for the protection of colonial communications by simply drafting out a garrison army to take its place ashore, you will thus relieve the immense strain brought upon our home reserves (ships and men) by doing so. Therefore, it is a part of my scheme that these strategical positions should be held during peace by naval forces in reserve. With regard to Colonel Leahy's remarks, I will make my answer as brief as possible. First of all, with regard to this question of localization, I think he and I differ more in respect of a particular term. He advocates fixed head-quarters; I advocate fixed head-quarters. I say localization is to make military connections lie in the same direction as a man's civil connections. (Colonel LEAHY: Fixed head-quarters for artillery, I say.) With regard to short service and localization, I am unable to see how the two things can be separated, and I will tell you why. The object of short service is to turn a man back upon the civil population and let him support himself, holding him liable to rejoin the military service. That man is absolutely serving in a particular district; and he will continue to serve as long as he is in the Reserve in the district where his civil connection is strongest. Therefore, I cannot see how you can set aside considerations regarding locality. The shorter the period of service, the stronger are the links that bind a man to a particular locality; therefore, as regards the military machinery by which the short-service man is to be supervised and trained, the more do circumstances connected with locality influence the construction of the military machine. Colonel Leahy lays great stress upon the fact of localization being necessary in Prussia, in order "to lessen the personal tax." If that is the object of localization in Prussia, the greater the personal tax in military arrangements, the more the retaining fee must be increased to induce men to serve under the voluntary system in the Reserve. Under the voluntary system, I think, it is more necessary "to lighten the personal tax." Under the compulsory system you can force any amount of inconvenience upon men by law; but with regard to the voluntary system, if you increase the personal tax, you relatively diminish the inducements to serve. Therefore, I say that if in any country where there is conscription it is found necessary to diminish the personal tax, as Colonel Leahy calls it, I say it is doubly necessary where you have the voluntary system. With reference to the age of men going to India, that is a pure question of when you enlist them. In Prussia they do not take men till 20 years of age; and I should be a strong advocate of trying to get as many as possible over 20 years of age. There is a greater willingness on the part of the men under 20 to enlist; therefore, by leaving in peace a great stratum of the population untouched until you want suddenly to enlist new men, an advantage is gained. With regard to the fixed head-quarters of the artillery, I must just make one remark. I was merely illustrating a general principle when I named the great fortresses as the only head-quarters of the garrison Army. This is the principle: That with regard to the head-quarters of the militia artillery corps, wherever there is a battery of strategical importance, there I say you should have militia artillery, and nowhere else.*

THE CHAIRMAN: You have heard Captain Colomb's very valuable paper. I think it reflects very great credit upon our service that three such valuable papers as Captain Colomb has read, Colonel Leahy has read, and Major Edwards has published, should have been produced. They show that we have in the service men who

* I desire to remark that I did not reply to the objection raised—"that the Royal Commission of 1866 thought localization neither expedient nor desirable"—because the Commission reported in favour of *long service*, and I only consider localization to be necessary in the case of *short service*.

think deeply, and who express themselves well on such important military subjects. At any rate, whatever our deficiencies in other respects, we have men among us who thoroughly understand the wants of our service. I congratulate you upon another thing, not only upon what you have heard, but upon what you will not hear, for as your Chairman, it is not my intention to detain you at any length. I daresay you will bear with me for a moment while I make allusion to the reference made by the last speakers to another place. I refer to the important discussion that is taking place to-night in Parliament upon army matters. We must all be aware that the issue of that discussion must be of great good or great evil to our service. I am sure you will join me in wishing that that discussion may end, whatever may be the issue, in retaining in the army that noble class of gentlemen who now fill the ranks of commissioned Officers. If we preserve the same fine youth, the same noble English manhood, the same gentle English blood in our commissioned ranks, I am sure the Officers of the future will respond most cheerfully and most successfully to the appeal that the Government and the country are now making to the Officers of the Army, in their awakened sense of the importance of scientific education. I am one of those who admire the youth of our Army. After an experience of 51 years, I think they are the finest youth in the world, and that they do not deserve the reproach that is cast upon them, viz., that they do not attend to professional and scientific education. The *laches* have been on the part of Government. There was my own beloved father, a practically scientific man, who for years was imploring the Government not to abandon their educational institutions, but rather to strengthen and increase them. But no, these were all abandoned, and the impoverished Institution which produced a few educated men, was absolutely strangled. The Government discredited professional knowledge by not employing these men. Hence it is that our Army is not so professionally well educated as it should be. But a new era is coming, and I repeat that if the same good and gentle blood is kept in the Army, I shall have no fear as to its future. But there was in the House of Commons the night before last two reasons assigned for doing away with purchase, which I entirely and utterly repudiate. As I read in the papers, it was stated as one reason for doing away with purchase, that the purchase Officers never went on service in the field, or upon service in the colonies, without thinking of the danger they incurred in connexion with the prices of their commissions. I call to witness against this statement the blood of our noble Englishmen that has been poured out like water, without one single thought of consequences. And I utterly deny the other reason stated, viz., that scientific knowledge is not to be acquired by purchase Officers. I call as evidence against that assertion the history of the past. There was Sir George Murray, Sir Charles Napier, Lord Hardinge, and a galaxy of men, all purchase men, who were trained under my own father. I say the purchase system has produced men of the very greatest eminence, not only in practical professional knowledge, but in professional science. Therefore, I assert that two wrong reasons were assigned for doing away with purchase. If it be done away with, I am sure you will all join me in saying, God grant that it may turn out for the best for our service.

LECTURE.

Friday, March 17th, 1871.

MAJOR-GENERAL J. H. LEFROY, C.B., R.A., F.R.S., in the Chair.

THE DETERMINATION OF THE EXPLOSIVE FORCE OF GUNPOWDER.

By Captain J. P. MORGAN, R.A.

THE subject has been investigated by some very able men, both theoretically and practically; but though the facts thus elicited are very valuable, the conclusions which have been derived from them are not sufficiently harmonious to warrant us in believing that the question has been completely solved.

I. WHAT HAS BEEN DONE.

1. *Theoretically.*

The explosive force of gunpowder may be calculated from the products of combustion, on the assumption that certain laws hold good, such as that the tension of a gas varies with its density and also with its temperature. It must, however, be borne in mind that these laws have been verified only within certain limits of pressure and temperature, and, therefore, when we come to such very great pressures and temperatures as are met with in the explosion of gunpowder, any conclusions founded on them must be received with caution until the results have been confirmed by experiment.

Robins, about the middle of last century, endeavoured to calculate the force of gunpowder from the amount of elastic fluid produced. He found that the gaseous products would occupy 244 times the bulk of the powder, at the temperature and pressure of the atmosphere. If this amount of gas were confined in a space of the same size as that occupied by the powder, the pressure would be 244 atmospheres, without making any allowance for the enormously increased temperature at the moment of combustion. By heating a piece of musket barrel to "the extremest degree of red hot iron"—his assumed temperature of exploded gunpowder—and cooling it in water with certain precautions, he found that the heated air it contained contracted to one-fourth of its bulk, and concluded that the increase of heat in-

creased the elastic force of the gases fourfold. Thus the 244 volumes of gas at the temperature referred to would possess an elastic force of 1,000 atmospheres, or 6·7 tons per square inch.

Gay-Lussac obtained 450 volumes of gas, and, estimating the temperature at 1000°C ., deduced a pressure of 2,137 atmospheres (14·3 tons).

Piobert accepted Gay-Lussac's determination of the quantity of gas produced, but estimated the temperature at 2400°C ., and thus deduced a pressure of between 4,000 and 5,000 atmospheres for the permanent gases alone. Counting the other products, which at this temperature he considered would be in a state of vapour at a high tension, he estimated the total pressure at 9,600 atmospheres (64 tons).

With regard to the solid products, he says:—*

“There thus exist two very distinct periods during the continuance of the phenomenon of explosion; the first during which the products are in the state of elastic fluids, the tension of the vapours adding themselves to those of the permanent gases; and the second period during which the permanent gases alone act, the vapours being condensed, and forming those residues of combustion termed ‘crasse,’ and which deposit themselves on the sides of the chamber in which the powder is shut up, because these products have not been able to escape during the time they were in the gaseous state.

“The explosion of powder may thus present great anomalies in the effects produced from one point of action to another, when the elastic fluids act only during the first period, which is that of greatest effort, and this should be taken into consideration every time the circumstances of firing do not remain identically the same; also the force of powder measured during this period has given rise to a great many valuations very different from one another; when, on the contrary, the force of the powder is measured after these effects, during the second period, it is estimated at much less than it is in reality, because in this case no account is taken of the tension of the vapours which no longer exist.”

Bunsen and Schischkoff obtained 193·1 volumes of gas, the production of which was attended by the development of 619·5 units of heat, and from this, taken in conjunction with the known capacities for heat of the products, they concluded that the temperature of the flame of powder, exploded in a closed space so that the gases cannot freely expand, is 3340°C . With regard to the residue, they say:—†

“Although a slight volatilisation cannot be denied, it may be shown from the calculation of the temperature of the flame that the tension caused thereby cannot amount to one atmosphere. The temperature of the flame of hydrogen burning in air is 3259°C . A fragment of powder residue fused on a thin platinum wire was gradually volatilised in a jet of hydrogen burning in air, but it never reached ebullition, and hence the tension of its vapour could never have attained one atmosphere.”

* *Traité d'Artillerie théorique et pratique.*

† Occasional Papers, Royal Artillery Institution.

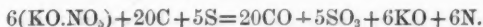
They conclude that the pressure can never reach 4,500 atmospheres (30 tons).

Mr. Abel remarks,* "The conclusions to which Bunsen and Schischkoff have been led by their elaborate investigation of the products of decomposition of gunpowder are, in the most important respects, so greatly at variance with the views hitherto adopted respecting the general nature of the chemical changes involved in the explosion of gunpowder, and consequently, with reference to the several conditions which influence the degree of force exerted by the explosion, that all who are interested in the considerations embraced in the research of these chemists, will be inclined to scrutinize closely the means by which they have arrived at their results before accepting them as likely to represent correctly the effects obtained by the employment of gunpowder in practice."

Their errors lie in their supposing that the products they obtained are the same as exist in the gun during the time of maximum effect. The solid residue, which forms about two-thirds of the total charge, is mainly carbonate and sulphate of potash. Mr. Bloxam† informs me that, from the appearance of this residue after deposition, he is decidedly of opinion that it has been deposited from the gaseous state. Further on we shall see that Rumford's experiments support this view. We are therefore at liberty to assume with Piobert that there are two actions, one during the time of greatest heat and pressure, and another afterwards. We may even go further than Piobert, and suppose that the solid products are not only in the gaseous state, but to a certain extent decomposed by the high temperature, in accordance with a chemical law, of which there are numerous examples, such as the decomposition of carbonic acid into carbonic oxide and oxygen at a high temperature, or of water into hydrogen and oxygen by the heat of the electric spark.

Keeping these considerations in view, I have prepared a formula which appears to be a very reasonable one. In the opinion of Professor Bloxam, to whom I have submitted it, we know so little of the effects of such extremely high temperatures upon the substances remaining after the explosion of powder, that the supposition is as allowable as any other. It is this:—

English powder, with one-quarter per cent. less nitre, gives an exact chemical formula which we may suppose to decompose thus:—



The method of calculating the amount of gas produced, with the temperature and resulting pressure, is as follows:—

* Chemist to the War Department, Occasional Papers, Royal Artillery Institution.

† Professor of Chemistry, King's College, London, Advanced Class of Artillery Officers, &c., &c.

Constituents.	Units of heat evolved.	Products.	Volumes of 23·3 cub. in.	Weight in grains.	Specific heat.	Units of heat required to raise 1° C.
20 C	297720	20CO	40	280	·174	48·72
5 S	176000	5SO ₂	10	160	·11	17·6
6(KO.NO ₃).	..	6N	12	84	·174	14·616
		6KO		282	·174?	49·068
	473720		62	806		130

Thus 806 grains of powder produce 62 volumes or 1444·6 cubic inches of gas at 0° C., and 1 atmosphere pressure; and, consequently, 1 cubic inch, or 240 grains, will produce 430 cubic inches of gas at the same temperature and pressure. The temperature of the products occupying 430 times the powder space will be $\frac{473720}{130} = 3644^{\circ}$ C., and the pressure, supposing the solid potash to occupy one-third of the space, will be $= \frac{3}{2} \times 430 (1 + 0.00366 \times 3644) = 9250$ atmospheres, or 62 tons per square inch.

Exception may be taken that no heat is here allowed for the decomposition of the nitre, nor for the latent heat of the gases evolved from it. But I may observe that, in all compounds containing nitrogen, the elements are very readily decomposed, and in some cases, such as nitrous oxide, heat is actually evolved by the separation of the atoms. The units of heat were obtained by Bunsen and Schischkoff with the gases expanded and much latent heat absorbed; but, in passing from the liquid to the gaseous state under great pressure, the law has been established that no latent heat is absorbed, and *vice versa*. We may therefore consider the temperature arrived at as not very different from that which exists at the moment of explosion, for any absorption of heat by decomposition would probably be more than counterbalanced by the heat which would be evolved if we were to reduce the 430 volumes to $\frac{2}{3}$ of a volume.

It is possible that the temperature may even be higher, and the pressure deduced is by no means the limit which might be attained, but is rather to be considered a minimum than a maximum, seeing that the products may be in a still further state of decomposition than has been assumed; for it is well known that at a high temperature carbon will reduce potassa; the tendency also of potassium to pass into vapour is well known. It is possible therefore that in the presence of carbonic oxide, and at such a temperature, the elasticity of the two vapours of potassium and oxygen may be sufficient to cause decomposition, and thus we should have all the products in the state of vapour with a corresponding augmentation of pressure.

This is not at all unlikely, for in the cases of gun-cotton and nitro-glycerine, the products of decomposition are much more dissociated by

being exploded in a confined space than when burned in the air. In their case the products, being carbonic acid, carbonic oxide, nitrogen, and aqueous vapour, have no tendency to reunite, and can be recovered in the very state in which they were at the time of maximum pressure; but, in the case of gunpowder, one of the products is potassium or potassa, whose strong basic attraction causes recombination, so that none of the other products, nitrogen only excepted, can remain free until it is satiated.

These considerations show, almost with absolute certainty, that the products obtained by the combustion of powder are not the same as exist in the gun during the time of greatest action, and we thus get rid of a difficulty which would tend to prevent our accepting the high pressures which we shall see are obtained by experiment.

Another consideration in favour of a possible high pressure is the limit to which the laws applicable to gases can be carried. At some point the liquid form would be assumed; and, though with low temperatures, the increment of pressure diminishes as the liquid form is approached, the same does not appear to hold good as the temperature is increased. Carbonic acid gas, so far as is known, cannot be liquefied above 80° F. With high temperatures the pressure may increase very greatly when the density is great. It may even approach the law of water pressure, which we know increases enormously with a small diminution of bulk. Thus even theoretically, the pressure may attain an amount which it would be impossible for us to restrain with all the appliances at our command.

It is necessary that we should have clear ideas on this point, as we shall see it is the slowness and regularity of the combustion of gunpowder that are the elements which make it possible to utilise its enormous pressure and keep it under control; and, to be of any practical use to us, even were we to know exactly what are the products of combustion, we must also know

The Rate of Combustion.

Robins made a very ingenious experiment to determine whether the explosion of gunpowder was instantaneous or not. He says:—*

“If part only of the powder is fired, and that successively, then, by laying a larger weight before the charge (suppose two or three bullets instead of one) a greater quantity of powder will necessarily be fired, since a heavier weight would be a longer time in passing through the barrel. Whence it would follow that two or three bullets would be impelled with a much greater force than one only. But the contrary of this appears by experiment; for, firing two and three bullets laid contiguous to each other with the same charge respectively, I have found that their velocities were not much different from the reciprocal of their sub-duplicates of matter.”

Though Robins, in accordance with his deductions of a small initial pressure, might have been prepared to accept the result he here states, yet others, who knew that his estimate was much too low, could not accept his conclusion, seeing that, if gunpowder were burnt in its own

* Ency. Brit. “Gunnery.”

space, no possible gun could withstand its explosive effects. It is to be remembered, however, that Robins made all his experiments with small arms, where the nature of the powder used would make the actual facts of the case approximate so closely to his deductions as to defy detection by the rude method he employed. Any windage would allow a greater escape of gas as the number of bullets increased, and, though the pressure might be greater at the commencement of the bullet's motion, such a loss would give rise to a diminished pressure afterwards. Sir Wm. Armstrong mentions another circumstance in connection with this:—*

"By using a slower burning powder, less heat and pressure are evolved at first, and the waste of heat in the stage of initial pressure being less, more heat remains for expansive action. Hence the slower burning powder is weaker at first but stronger afterwards, and, although the total quantity of gas be only the same, and the pressure not so great at any point, yet the aggregate pressure throughout the bore may equal that of the more energetic and more dangerous powder."

It is not surprising that Robins should have failed to detect all the points of a most difficult question on which long experience alone has succeeded in shedding but even yet a faint light. The wonder is that living in the time he did, he should have discovered so much. When he took up the question, gunnery was not a science, but was very much in the state in which Newton found astronomy. The subject had to some extent been treated in a rude practical way, and wild speculations had been made as to the nature of the forces at play, but the matter had never once been scientifically approached. The fact, too, that all his results, obtained with the aid of small arms, have in the main been found to extend to the biggest guns without the discovery of any new law, must always make Robins occupy the first place in the estimation of every artilleryman.

The question of the instantaneous explosion of gunpowder is one of extreme importance, for, independently of the increase of the actual amount of pressure which it would cause in a gun, it has another bearing on the subject of almost equal importance. In a paper read here last year,† I have given a rigid mathematical demonstration which shows that a sudden pressure has twice the destructive effect on a gun that the same pressure would have if slowly applied. Mr. Mallet also has illustrated this point very clearly, by showing that a weight would bend a support twice as much when suddenly applied as it would when slowly applied. Any one can test it with a spring balance.

Long experience has shown that it lies in our power to vary the rate of combustion of gunpowder, and in this gunpowder differs very much from gun-cotton. In gun-cotton the instability which renders explosion possible is brought about by chemical action, so that atom finds atom in closest proximity ready for immediate recombination if only sufficient temperature be attained. In gunpowder, on the contrary,

* Address as President of the Institution of Mechanical Engineers, Newcastle meeting, 1869.

† Vol. xiv., p. 479.

the instability is produced by mechanical mixture, and, on a minute scale, the particles of charcoal are burned like coals in a fire. With gunpowder in its rude state, the difficulty was to get the particles close enough together to make the combustion sufficiently rapid, and it was not till the importance of thorough incorporation was understood, that any real progress was made in rendering it a destructive agent. Even with thorough incorporation, it was necessary to provide for the rapid ignition of the various particles, for the combustion could not travel with sufficient rapidity through the entire mass. To make the action energetic enough, it was necessary, as it were, to light the fire in a great many places. Granulation effects this by allowing the flame from one point of ignition to spread throughout the charge and ignite all the grains very nearly simultaneously. It also has the good effect of preventing any separation of the ingredients when once thoroughly incorporated. Thus the action depends on the rapidity of ignition of the grains, and the rate of combustion of each grain. The rapidity of ignition of the grains depends on the size of the spaces between the grains, and the rapidity of combustion on the smallness of the grains themselves; but as these are opposed to one another, we can readily see that with some size of grain, which is most favourable to both requirements, the combustion of the whole charge will be the most rapid. Small grains will burn rapidly, but the spaces between them being also small, the ignition will not be so rapid. Large grains will burn slowly, but will admit of rapid ignition. The shape of the grain is another element to be considered, but one of still more importance is the density, for, if the grain be porous, the flame will not only pass between the grains, but also penetrate into their mass. We shall obtain the most rapid combustion, therefore, by combining a certain size and shape of grain with a certain density of grain; and, if we wish to moderate the rate of combustion, we must not only increase the size of the grain, but also increase its density, especially in large guns, where the pressure is very great.

The objects to be attained in regulating the size and density of the grains are, the greatest possible velocity of projectile combined with the least strain on the gun. These cannot be obtained by one set of conditions for all natures of ordnance. A small projectile moves quickly, and relieves the strain in a still greater ratio. A heavy projectile not only moves slowly, but even a considerable motion does not relieve the strain in a proportionate manner, because the column of powder is longer in a large than in a small gun. With small arms, consequently, we must use fine grain powder, but large grain powder with heavy guns. Owing to the effect heat and pressure have in accelerating the combustion, we cannot determine *a priori* what size or density of grain will suit any particular gun. This, and as a consequence the actual pressure in the gun itself, can only be determined.

2. Practically.

Rumford was the first who attempted to obtain the pressure of gunpowder by actual experiment. Not being able to find any material strong enough to confine it when exploded in its own space, he measured

Fig 1.

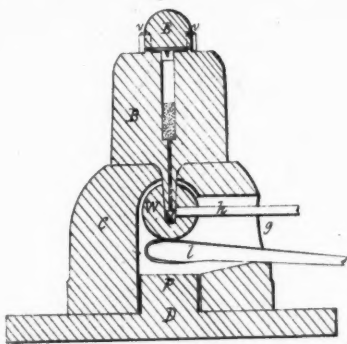


Fig 2.

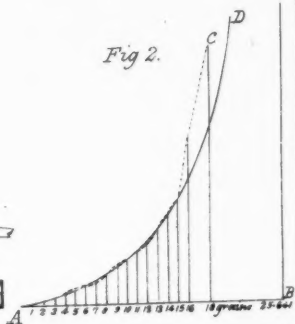


Fig 3.

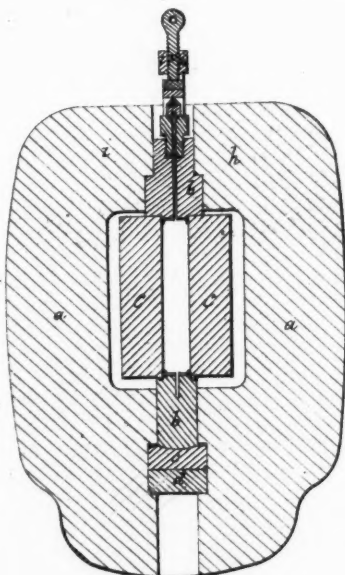
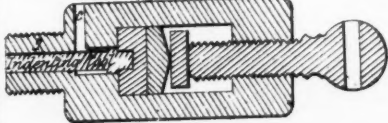


Fig 5.



Fig 4.

Indenting Apparatus



the pressure when exploded in closed spaces bearing various relations to the bulk of the charge, and had it been possible to combine this method with a knowledge of the rate of combustion, he would have completely solved the question. The plan he adopted was to make a small, short, strong gun, the muzzle of which he confined with a heavy weight, varying the charges and so regulating the weight that the force of explosion was just sufficient to lift it.

In this way he obtained the various pressures, and made a calculation of what the pressure would be if the charge were exploded in its own space. No vent or escape of any kind was allowed. The charge was fired by means of a red-hot ball, which communicated the heat through the walls which contained a long narrow chamber at the base of the charge. Fig. 1* shows the method used; the enclosing weight was placed on the top, and is not shown.

The bore was $\frac{1}{4}$ inch diameter at the top, and the actual capacity of the whole gun was $25\frac{1}{2}$ grains.

The following table gives the pressures obtained with a varying quantity of powder in grains. The first column gives the actual pressures, the second the pressures calculated according to what appeared

Charge in grains.	Ratio of charge to space.	Pressure in tons per square inch.	
		Measured.	Calculated.
1	·039	·5	·5
2	·078	1·2	1·1
3	·117	1·5	1·8
4	·156	2·5	2·6
5	·195	3·7	3·6
6	·234	4·6	4·8
7	·273	5·4	6·2
8	·312	7·8	7·8
9	·351	10·3	9·8
10	·390	12·6	12·1
11	·429	14·8	14·9
12	·468	17·1	18·1
13	·507	21·9	22·
14	·546	26·7	26·5
15	·585	31·5	31·9
16	·624	47·3	38·2
17	·663		45·6
18	·702	73·2	54·3
19	·741		64·5
20	·780		76·5
25½	1·		194·5

* The Institution is indebted to the Royal Artillery Institution, Woolwich, for the use of the stones to illustrate this paper.—ED.

to be a law. Sometimes the weight was lifted with an explosion like that of a gun, at others it was not raised at all. The result was taken when it was just lifted with a very small escape of gas.*

The curve in Fig. 2 shows the calculated pressures. They agree very well with the measured pressures up to 15 grains. The pressures afterwards are calculated without taking into account the higher pressures, which appeared to manifest themselves as the cannon began to fail. If these higher pressures were taken into account, Rumford considered that 100,000 atmospheres, or nearly 700 tons, would not be too great an estimate of the force of powder exploded in its own space. Piobert, however, considers that the higher pressures were probably due to the yielding of the metal at the top as it began to fail.

Observing that when the space is three times that of the charge the pressure is, in round numbers, 10 tons; when it is twice, 20 tons; once and a half, 40 tons; and once and a quarter, 80 tons; a very simple empirical formula, applicable to guns, may be given, founded on the supposition that the pressure varies inversely as the amount of extra space which is added to that of the charge consumed:—

$$\begin{aligned}
 &\text{If } P = \text{pressure in tons,} \\
 &\quad l = \text{length of charge,} \\
 &\quad y = \text{proportion of charge consumed,} \\
 &\quad x = \text{distance moved by the shot,} \\
 &P = \frac{20y}{\frac{x}{l} + 1 - y}.
 \end{aligned}$$

“What was very remarkable in all the experiments in which the generated elastic vapour was completely confined, was the small amount of expansive force which the vapour appeared to possess after it had been suffered to remain a few minutes, or even only a few seconds, confined in the barrel, for, in raising the weight by means of its lever, and suffering this vapour to escape, instead of escaping with a loud report it rushed out with a hissing noise hardly so loud or so sharp as the report of a common air-gun, and its effects against the leathern stopper by which it assisted in raising the weight were so very feeble as not to be sensible. On examining the barrel, however, this diminution of force in the generated elastic fluid was easily explained; for what was undoubtedly in the moment of explosion in the form of an elastic fluid, was now found transformed into a solid body, as hard as a stone.

“That this hard substance, found in the barrel after an explosion in which the generated elastic fluid had been completely confined, was actually in a fluid or elastic state in the moment of explosion, is evident from hence, that in all those cases in which the weight was raised and the stopper blown out of the bore, nothing was found remaining in the barrel. It was very remarkable that this hard substance was not found distributed about in all parts of the barrel indifferently, but more of it was always found near the middle of the

* Philosophical Transactions of the Royal Society of London, 1797.

"length of the bore than at either of its extremities; and the upper part of the vent-tube in particular was always found quite filled with it. It should seem from hence that it attached itself to those parts of the barrel which were soonest cooled; and hence the reason, most probably, why none of it was ever found in the lower part of the vent-tube, where it was kept hot by the red-hot ball by which the powder was set on fire."*

A better plan than that adopted by Rumford for measuring the actual pressure cannot be conceived. We have considered the nature of a suddenly applied pressure in doubling the strain on yielding material, but a suddenly applied pressure in this case would make no difference, for the absolute weight keeping the powder enclosed would not yield to any pressure less than itself, and so would show the same result whether the pressure were suddenly or slowly applied.

There is, however, another kind of pressure to be considered. It was investigated by Robins in the following manner. By firing a musket charged with a light wad against a pendulum he considered the velocity of forced gunpowder to be 7,000 feet seconds. He says:—

"From these determinations may be deduced the force of petards, since the action depends entirely on the impulse of the flame, and it appears that a quantity of powder, properly placed in such a machine, may produce as violent an effect as a bullet twice its weight moving with a velocity of 1,400 or 1,500 feet per second."†

In order to discover what effect this action had on the velocity of the bullet, Robins placed 12 pennyweights of powder at the bottom of a musket and a bullet $11\frac{1}{4}$ inches from the bottom of the bore, and found that the velocity imparted was 1,400 feet per second instead of a calculated velocity of 1,200 f. s. without the action in question. When the same quantity of powder was scattered through the whole space the velocity was only 1,100 f. s.

By placing a bullet 16 inches in front of the charge in a "good Tower musket," he found that "the part of the barrel just behind the bullet was swelled out to double its diameter, like a blown bladder, and two large pieces 2 inches long were burst out of it."

We have every reason to believe that the action here referred to does exist, and also that it is local and does not extend throughout all the space in which the pressure of the powder acts. Under these circumstances the thinner the confining surface at the point of action the more injurious would be the effects produced. With a thick wall, as in a gun, the action would be more distributed, and, though it might indent the surface of the bore as by a blow, it might not succeed in endangering the structure of the gun. For the same reason it is more than likely that any action of the sort would not appreciably interfere with Rumford's results, as well on account of the great mass on which he received the pressure as on account of the fact that a small motion of the weight had to take place before any gas could escape.

It will be observed, however, that though Rumford's experiments are most valuable in showing the extraordinary force of fired gunpowder and

* Philosophical Transactions of the Royal Society of London, 1797.

† Ency. Brit. "Gunnery."

its pressure when occupying various spaces; yet, because they leave out of account the rate of combustion, on which mainly depends the amount of relief given by the motion of a shot in a gun, they do not help us practically. We consequently find that succeeding experimenters have turned their attention to some method of determining the explosive force of powder which includes this most important element.

Rodman is the next whose experiments we must consider. He endeavoured to measure the pressure in the bore from the recoil of the gun, swung as a pendulum, by causing it to trace a curve on a revolving cylinder. As, however, the whole space of recoil was less than an inch, nothing more than a general outline of the pressure could be obtained. He says:—*

“The curves described show that the gun and shot had acquired one-half of their final velocity in about one-fourth of the time required for the shot to pass from its seat to the muzzle of the gun; therefore the mean pressure in the bore of the gun, during the first fourth of that time, must have been double that for the whole time, or = 18,182 lbs. (8 tons) per square inch. They further show that the shot and pendulum had acquired one-fourth of their final velocity in about one-sixteenth part of the whole time aforesaid, and that the mean pressure during the first sixteenth part of that time was = 36,264 lbs. (16·2 tons). And the pressure will be still greater during the lower rates of velocity, amounting to probably 50,000 lbs. (22·3 tons) per inch; and this estimate is for a statical pressure, the strain due to which, as will be shown further forward in this Report, must be considerably less than the actual strain, the rate of application of the force affecting the strain, to which it subjects the resisting body, so far as even to double it in the extreme case, or when the application of the force becomes instantaneous.”

He conducted a much more elaborate and valuable series of experiments to ascertain in the very bore itself what was the actual pressure at each point. In order the better to judge of the value of his deductions, it is necessary to give a short account of some preliminary experiments which were made with hollow cylinders to test their strength.

Major Wade gives the hydrostatic pressures necessary to burst cast-iron hollow cylinders cut from the chase of a 6-pounder gun, of one-quarter and one-half calibres thickness, compared with the tensile strength of the iron.†

Tenacity.	Tons per square inch.	Proportion.
By direct tensile force	14·8	1
By water pressure { Thickness equal to half a radius..	11·1	·742
Thickness equal to radius	8·9	·602

These pressures agree so well with what might be expected from the law of decrease of proportionate strength as the thickness increases, that I have no hesitation in accepting them as correct. The law of decrease only holds strictly as far as the elastic limits up to which the

* Experiments on Metals for Cannon and Cannon Powder. Rodman.

† Reports of Experiments on Metals for Cannon, by Officers of the Ordnance Department, United States' Army.

extension is uniform; beyond the elastic limits the extension increases more rapidly than the strain. Thus there is a slight increase of the proportion of strength given when the thickness was one-half calibre, which by calculation would otherwise be equal to half the tensile strength of the metal.

Rodman tested similar cylinders with gunpowder. The cylinders, like the last, had the column of metal in the walls of the same length as the bore on which the pressure acted. The length was 12 inches, and the calibre 2 inches. The thickness of metal was varied. The following table shows the actual pressures measured when these cylinders were burst by powder exploded in the interior. Alongside the actual pressures is given a set of pressures calculated according to the law which regulates the strength of hollow cylinders, and made to agree with the instance in which the thickness of metal was one-half calibre in Rodman's experiment, the particular thickness being chosen because it required two charges to burst it, and may therefore be considered as just burst, and no more (see Fig. 3).

I have given Major Wade's hydrostatic bursting pressures for comparison.

Thickness of metal.	Mean bursting pressure by experiment.	Computed bursting pressure.	Hydrostatic bursting pressure.
.5 inch	16.9 tons.	11.4 tons.	5.5 tons.
1 "	17.1 "	17.1 "	8.9 "
1.5 "	28.3 "	20.6 "	..
2 "	35.8 "	22.8 "	..
2.5 "	41.2 "	24.4 "	..
3 "	41.8 "	25.7 "	..
Tenacity	12. "	..	..

It will be noticed that even in the most favourable case for comparison, viz., that in which the cylinder was just burst, the pressure obtained by gunpowder was about double the hydrostatic pressure. This is a very serious discrepancy, and is sufficient to cast a doubt on the accuracy of his method of measuring the pressure, which was by fixing a "pressure gauge" in the gun at various distances along the bore. The pressure was inferred from the distance an indenting tool was pressed into a wrought iron or copper specimen, the force necessary for any particular indentation having first been obtained by statical pressure.

Fig. 4 shows this gauge.

Rodman tried the effect of varying the charge and shot in a gun. He fired a 43 lb. round shot with charges varying from 3 to 12 lbs., and found that the pressure varied very accurately as the charge; he also fired from the same gun, with a fixed charge of 5 lbs., shot varying from 35 to 85 lbs., and again found that the pressure varied with the shot. He says:—*

* Experiments on Metals for Cannon and Cannon Powder. Rodman.

"The nearest approximation to any regular law of variation of pressure due to variation of charge and projectile, discoverable in the results obtained from the series, with a constant weight of projectile and variable weight of charge, and that with a constant weight of charge and variable weight of projectile is, that with a constant diameter the pressure increases directly as the product of the weight of the charge by that of the projectile."

This law is much severer than that of Rumford, and, unless we account for it by his method of measurement being inaccurate, we must do so by concluding that the rate of combustion increased with the charge and projectile on account of the greater heat and pressure developed."

He next tried varying the bore, with the following results:—

"Table showing the velocity of shot in feet per second, and pressure of gas per square inch (in tons) due to equal columns of powder behind equal columns of metal, when fired in guns of different diameters of bore, each result being a mean of ten fires.

Diameter of bore.	Windage.	Weight of charge.	Weight of shot.	Velocity, f. s.	Pressure at different distances from bottom of bore.						
					At bottom.	At 14".	At 28".	At 42".	At 56".	At 70".	At 84".
7"	·07"	lbs. 5·13	lbs. 74·44	904	16·3	7·1	3·7	2·9	3·1	3·6	3·
9"	·09"	8·48	124·42	888	30·	9·4	7·9	6·7	13·1	9·4	10·2
11"	·11"	12·67	186·03	927	38·7	13·1	12·4	10·	12·7	15·1	11·2

"The points most worthy of note in these results are the very marked increase in the pressure of gas as the diameter of bore increases, and that the indications of pressure are greater at 56, 70, and 84 inches than at 42 inches, especially in the 9-inch and 11-inch guns."

The former Rodman accounts for by the greater heat developed in a large than in a small charge. The small bore, too, abstracts a greater proportion of heat by means of the walls of the gun, and also allows a greater proportion of gas to escape by means of the vent. The increase of pressure towards the muzzle he believes "to be due to the more violent and sudden contraction in the thin than in the thick part of the gun. . . . For in the thick part of the gun the pressure is much less rapidly developed, and subsides much more gradually, the contained gas forming an elastic cushion, which would, if the bore were long enough, allow this part of the gun to return from its strained to its free condition, without any vibration at all: while in the model used in these experiments the pressure is almost instantaneously developed and as suddenly subsides in the chase of the gun, so that while the indenting piston is on its way outward, it is suddenly met by the returning specimen, which is drawn in along

"with the housing by the contraction of the gun, with such violence as to amount in effect to a smart blow of the indenting tool against the specimen. Close examination shows a number of marks or cuts of the indenting tool on the specimen in this part of the gun, caused by the tool not striking in the same place at each vibration of the gun."

If this explanation be the true one, it may account for the unsatisfactory results given by his gauge as to absolute pressures. That it does not give the absolute pressures is manifest, for in the 11" gun, we find the pressure per square inch throughout the bore more than double that of the 7", and yet the resulting velocities remain the same, or nearly so. It is possible that it may represent the destructive action on the gun, and may be accounted for by a sudden pressure which sets up vibration in the powder-chamber to be continued throughout the bore, the greater intensity towards the muzzle being due to the same cause, which makes the waves of the sea more violent as they come into shallow water.* That, however, the destructive action on the walls is the same in amount as that indicated by the gauges cannot be relied on, because the action shown by the gauges is the result of the compound vibration of both walls and indenting tool.

He also tried the effects of varying the size of the grain of powder with the following results:—

"Table showing the velocities of shot and the pressure of gas, due to equal charges of powder, of the same composition, and differing only in size of grain—each result being the mean of five fires—
"with the 11" gun, the same shot being used in all the fires.

Diameter of grain.	Weight of charge.	Weight of shot.	Initial velocity.	Pressure of gas in tons.		
				At bottom.	At 14".	At 28".
	lbs.	lbs.				
6"	12·67	186·3	933 f. s.	9·5	4·6	3·6
5"	"	"	932 "	9·5	5·	3·3
4"	"	"	881 "	11·4	4·8	3·2
3"	"	"	890 "	15·8	4·8	3·
3"*	"	"	912 "	29·4	6·6	3·7

* Powder of 1859, but not so hard pressed as that of 1860.

This is one of the most important points Rodman has drawn attention to, for in this way the maximum pressure can be reduced, and yet the initial velocity maintained.

As, however, there is a danger of carrying even this advantage to an extreme, I shall premise another set of experiments made by Rodman, which will serve to illustrate the point I refer to.

He tried statical pressure through the medium of soft wax in

* I have heard Professor Rankine give the explanation, in a lecture on Waves at Newcastle-on-Tyne.

cylinders bored out like a gun on a small scale (see Fig. 5). Various lengths of the bore were filled with the wax and the bursting pressures obtained. The calibre was 1.128 inches, and the thickness of metal one calibre. The following are the results:—

Length pressed.	Mean bursting pressure.	Length pressed.	Mean bursting pressure.
6 inches.	24 tons.	7 inches.	27.1 tons.
5 "	26.8 "	2 "	33 "
4 "	32 "	2 "	29.4 "
3 "	34.8 "	2 "	40.3 "
2 "	39.1 "	2.6 "	42 "

Rodman considers that these pressures are high owing to the want of perfect fluidity in the wax. They serve, however, to show a law which is represented in Fig. 6, where the horizontal and vertical co-ordinates of the curve represent the lengths of bore and bursting pressures respectively. The benefit to be derived from the operation of this law may be shortly stated thus: with two calibres the circumferential strength is increased by one-half, while beyond five calibres no advantage is gained by it. It will be noticed, that if the powder burn very slowly, the shot will move during the first and most important part of its course under a much smaller pressure than the gun is capable of sustaining with a corresponding loss of velocity.

The maximum pressure should be obtained as soon as possible, and should not be allowed to subside too rapidly, but should be continued as nearly as possible in accordance with the curve given above. The maximum pressure ought not, however, to be obtained so rapidly as to partake of the nature of a sudden pressure, *i.e.*, it should not be obtained so rapidly as not to give the metal of the gun time to expand before it has reached its maximum. The law above given has also a very important bearing on the size of the bore of the gun, for, in addition to giving a smaller pressure per square inch, a larger bore will not throw the pressure so far forward with the same charge of powder.

Committee on Explosives.

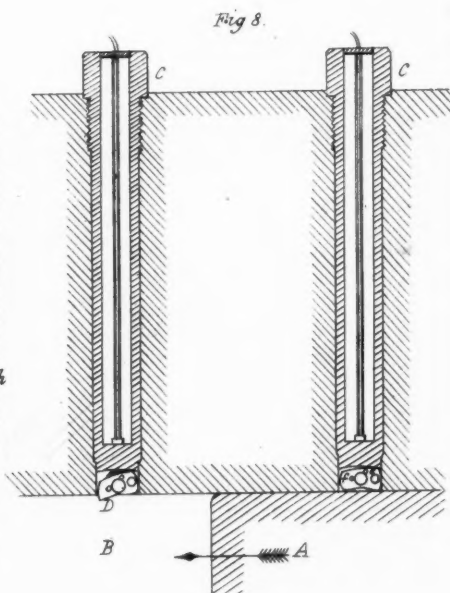
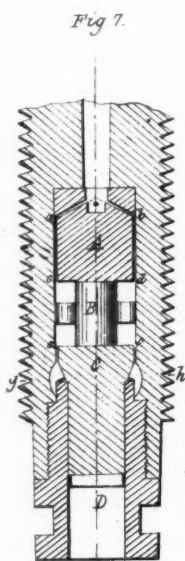
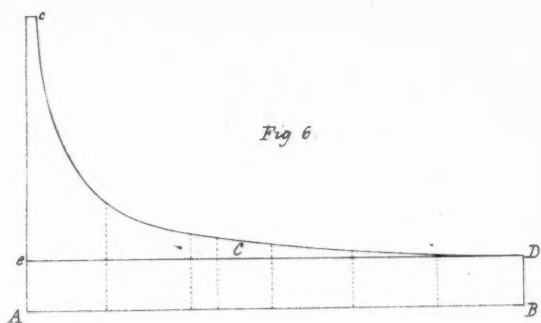
Somewhat tardily in our own country this Committee has been appointed to consider, amongst other things, the question of most pressing importance before proceeding with the manufacture of very heavy guns, *viz.*, to find a powder which, in the monster ordnance we are about to construct, will give the greatest initial velocity of projectile with the least strain on the gun.

In our heavy service guns, when R.L.G. powder is used, we find the initial velocities decreasing with the size of the gun; thus—

Nature of gun 7 inch, 8 inch, 9 inch, 10 inch, 600-pr.
Initial velocity..... 1458, 1363, 1336, 1298, 1180.

This result is entirely due to the use, with these guns, of powder





suitable only for smaller natures; for, if the guns are of the same construction and equally perfect manufacture, they will stand the same strains, and if the strains be the same throughout corresponding lengths of bore the initial velocities ought to be identical.

It is true no doubt that in heavy guns the manufacture slightly deteriorates and the length in calibres has to be decreased, but these are reasons, if we wish to retain the velocity and at the same time not overstrain the gun, for making the law of pressure conform more instead of less closely to the strength of the gun as the various lengths of bore come under the influence of pressure. Any departure from this will result either in a loss of initial velocity or cause an undue strain on the gun at some particular point.

Perfection would be attained by having a special powder suitable for each nature of gun, but practically this cannot well be carried out. It is of all the more importance therefore that we should be provided with the fullest information on the subject, that we may be able to decide on some single powder suitable to all heavy guns, or on two or more sorts, the mixture of which will best answer the purposes required.

To a great extent the Committee have, in their investigations, followed in the footsteps of Rodman, *i.e.*, they have endeavoured to obtain the pressures as they actually occur in the bore, and, like him, they have adopted two methods of doing so.

Instead of his "pressure gauge" they use a "crusher gauge," a representation of which is given in Fig. 7; and, instead of estimating the pressure from the velocity of recoil of the gun, they do so from the velocity of the shot in the bore.

For this last purpose they make use of a "chronoscope," invented by Captain Andrew Noble, late R.A., of Elswick. It notes the moments of passing various points in the bore by electric sparks which arise from the shot in its course causing projecting tools to shear wires in succession, as shown in Fig. 8.

Their experiments have been confined to four kinds of powder, *viz.*, R. L. G., prismatic, pellet, and a new sort called pebble. The following results have been obtained with the 8'-inch gun by the chronoscope:—*

Nature of powder.	Charge.	Initial velocity.	Maximum pressure.
R. L. G.	30 lbs.	1324 f. s.	29·8 tons.
Russian prismatic.	32 "	1366 "	20·5 "
Service pellet.	30 "	1338 "	17·4 "
Pebble No. 5. Density } 1·78.	35 "	1374 "	15·4 "

The pressure curves during the initial stages of the shot's motion are given in Fig. 9.

* Preliminary Report; Committee on Explosives.

By the empirical formula I have derived from Rumford's experiments put in the form of—

$$y = \frac{P}{20 + P} \left\{ \frac{x}{l} + 1 \right\}$$

I deduce the respective proportions of each of those powders which are consumed at the time of the maximum pressure to be R.L.G., 60 p. c., prismatic, 57 p. c., and pebble, 43 p. c.

The comparison of the prismatic and pebble curves is most suggestive, for though the prismatic charge is only 32 lbs. while the pebble is 35, and though the prismatic begins to burn more slowly than the pebble, yet not only does the prismatic very nearly maintain its velocity, but actually shows a greater pressure than the pebble, and that too at a point further forward in the gun.

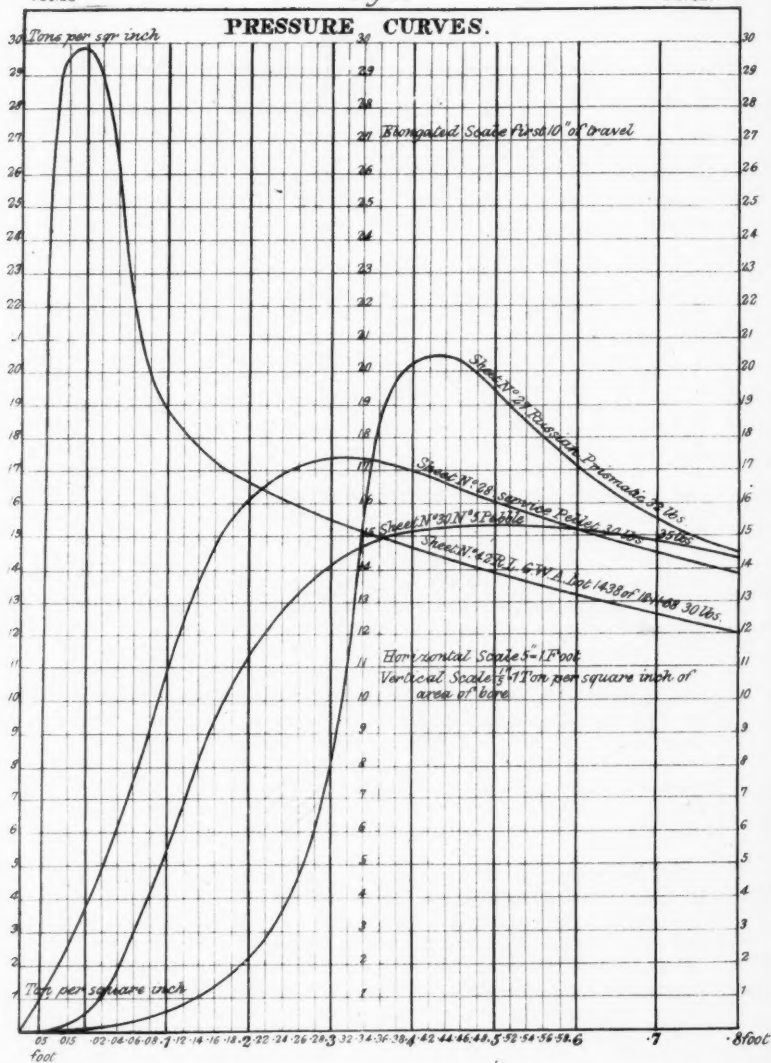
It does not follow from this that at any point as regards time more prismatic than pebble is consumed, as will be evident by a reference to the time curves given in Fig. 10, but, as regards space moved by the shot, it does. It may to a great extent be due to the shape of the grain, which allows of greater acceleration of combustion. The fact that at the time it occurs the shot is moving less rapidly may also have something to do with it. But it is not to be left out of consideration that it may be due to another cause, for the low initial pressure would be favourable to ignition, and thus in the case of the prismatic, the whole charge may become more thoroughly ignited than in the case of the pebble, and though the combustion be less rapid at first, it may proceed with greater intensity afterwards. The greater velocity and less pressure of the pellet as compared with the R.L.G., may be similarly accounted for.

That there is room for an increased acceleration of combustion, is evident from the moderate amount of powder consumed at the time of the maximum. This supposition would also appear to explain the unaccountable fact of unconsumed grains being blown out of the gun when large charges are used, for the truth of which I can vouch. It is probable that the violent commotion set up in the chamber on first ignition of the charge is such that, more especially in long charges, portions are driven to the extremities and become so packed together by the enormous pressure, as to prevent thorough ignition of some of the grains.

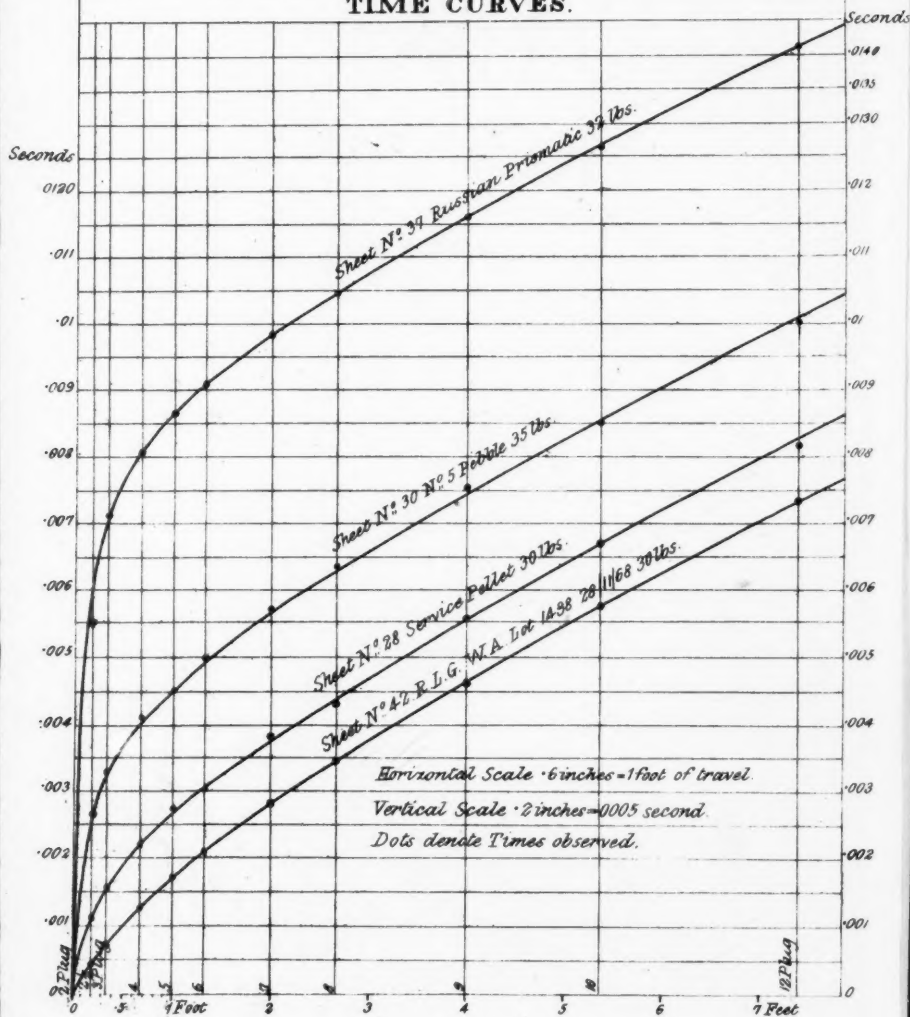
I am aware that it is usual to consider that the amount of powder consumed depends on the burning of each grain from the surface towards the centre, and that most of these curves might be explained in this way.

Sir Wm. Armstrong we have seen explains the anomaly of the Pellet maintaining its velocity against R.L.G., by the loss of heat which the latter sustains during the initial stage of combustion. There are, however, as we shall see, other points not so easily explained on the theory usually adopted. Whatever be the cause, the pebble is undoubtedly a better curve than the prismatic, and shows some advantages in addition to its less maximum; for the maximum pressure of the pebble takes place before that of the prismatic, and also there is less appearance of suddenness in the former than in the latter. The prismatic gets up the pressure very slowly at first, but, when about to





TIME CURVES.



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reach the maximum, it takes a sudden rise, which may possibly be rapid enough to produce partially the effect of a sudden pressure. Its maximum is 20·5 tons; but suppose the pressure rises slowly up to 12 tons, and then suddenly becomes 20, we should have a pressure of 20 tons met by a resistance of 12, 13, 14,—20 tons in succession, during which time the walls of the gun have acquired a velocity outwards, requiring a resistance of 20, 21, 22—28 tons in succession to bring them to rest. The walls would again vibrate back to 12 tons, and out to 28 tons, increasing the injurious effects on the gun.

With the 10-inch gun,

“The principal average results, in various series of six rounds each, are shown in the following abstract, the pressure given being the highest as indicated by the crusher gauge.”*

Nature of powder.	Density.	Charge.	Velocity.	Pressure.	Remarks.
R. L. G.	1·742	60 lbs.	1318 f. s.	51	
	1·733	60 "	1321 "	48	
	1·67	60 "	1313 "	53	
Pellet.....	1·677	64 "	1364 "	25	
Prismatic Russian	1·66	61 "	1335 "	19	One round.
		68 "	1425 "	29	
Prismatic Ritter ..	1·66	61 "	1349 "	21½	One round.
		70 "	1416 "	24	
Pebble	1·732	70 "	1474 "	29	Uniform grain.
	1·782	70 "	1432 "	21	
	1·732	60 "	1350 "	21	One round.
	1·782	60 "	1298 "	15	One round.

We here see the remarkable fertility of the subject, the initial velocity being increased by more than 150 f.s., when pebble powder is used, while the strain is very much reduced. The great importance of density is also shown, leading us to believe that this is one of the most important points to be taken into consideration in the manufacture of powder for very heavy guns.

With slow burning powders, the Committee state, the indications of pressure given by the “crushers” have been found to correspond very closely with those deduced from the chronoscope,† but this is not the case with quick burning powders nor even with slow burning powders when fired in large charges in very heavy guns. From Rodman’s experience with his pressure gauge, we cannot doubt that the crusher is not in all cases to be relied on. It seems to indicate intense local pressures which are greater as the point of their action is more distant from the point of ignition of the charge; greater at the extremities of the chamber than at the point of ignition in the middle, and greater when the crusher is at a distance from the bore than when

* Memorandum, 12th July, 1870; Committee on Explosives.

† This can only refer to the chronoscopic pressures at and after the maximum. During the ascending branch of the curve the crushers can only show the maximum pressure.

close to the bore, amounting in some cases to double the pressure deduced from the "chronoscope" or even more. As an instance, the Committee state that, with R.L.G. in an 8-inch gun, when the "crusher" was close to the bore, the pressure indicated was $22\frac{1}{2}$ tons, but, when at a distance, it was 40 tons per square inch.

The occurrence of these pressures would appear in the estimation of the Committee to correspond with the notion already mentioned as having been investigated by Robins, of the gas first formed being suddenly arrested when at a high velocity and converted as by a blow into pressure. But when the crushers are put in a second time, little or no further setting up takes place, as would be the case if the action were due to a blow produced by the mass of gas in motion. Under such a supposition the intense pressures would take place before the general maximum is attained, and it is difficult to conceive that the necessarily small mass of gas is sufficient to produce the results manifested.

It is more reasonable to suppose that they occur at the moment when the general maximum exists, and may be superadded to it. In addition, it appears both from Rodman's experiments and those of the Committee, that when once the action is set up, it is continued throughout the bore, which would not be the case were it due to the velocities of the gases first ignited. This continuance of the action is also unfavourable to the supposition that it is due to an intense general pressure of the amount indicated, which, as shown by Rodman, would gradually subside as the gas expanded and produce no further vibration. It might, however, be explained were the general pressure of the nature of water pressure which would suddenly subside with a very small motion of the shot, and so produce vibration by sudden cessation; and in support of this view it may be said there is a marvellous harmony in the fact that Rumford, Rodman, and the Committee all find these pressures manifesting themselves somewhere about 30 tons.

The apparently local nature of the pressures might be accounted for by the relief which would be given at those points where the gas could escape, such as the vent and the base of the shot. The vibration however, would equally be set up by a moderate general pressure if it were suddenly applied, and which, acting on the "crusher" and walls of the gun would, in the first instance, produce effects on each varying with their masses, the spaces described, and the resistances, and afterwards set up an action which would be most felt by the "crushers," because they would partake both of their own motion and that of the walls of the gun.

There is yet another supposition which would account for these pressures.

If the charge when ignited burn uniformly, the grains nearest the point of ignition will naturally be in a more advanced state of combustion than those further away.

A great pressure and temperature will arise causing increased combustion, which will be most felt where the greatest amount of powder remains to be consumed, and where it may be supposed to be a mass of half-burnt grains crushed to dust by the pressure proceeding from the point of ignition, a condition most favourable for intensely rapid com-

bustion. Thus sudden local pressures would be manifested at these points and be continued through the chamber by a sort of wave motion which, passing backwards and forwards, would manifest the greatest effects where the direction of its motion was changed, viz., at the base of the shot and at the bottom of the bore. The facts that indentations are found in the bore at the base of the shot, and also that so much trouble has been found in preserving the bottom of the bores from the action of the powder appear to favour this view. The continued action throughout the bore also accords with it. On this supposition the pressure would be often repeated, but the whole of the chamber would not be under its influence at the same time, and the structure of the gun would not be so injuriously affected as the more limited surfaces of the crushers.

These anomalous pressures would thus appear to be due to one or other of two causes, either a wave motion in the gas originated somewhat in the manner described, or a vibration or wave motion in the walls of the gun set up either by a very intense water pressure, or by a less intense gaseous pressure suddenly applied.

I have long been favourable to the notion that the wave motion exists in the gas; but a consideration of the enormous pressure of which gunpowder is capable, and the exceeding rapidity with which it is augmented, make me doubtful if the action be not due to vibration in the walls of the gun, and of a very dangerous character. The practical point is to decide between these two views, and to determine whether the destructive action in the gun is comparable to the indications of the crushers.

These questions, though very necessary, are of such extreme delicacy that the chronoscope must fail to detect them, owing to the fact that it does not note the motion of the projectile continuously throughout the bore, but only from point to point, so that a pressure of great intensity but very short duration, may occur between two points of observation which cannot be separated from the general law of pressure, but must be absorbed in it, causing a modification.

The action in question we may assume to be originated during the initial stages of the shot's motion, where the wires of the chronoscope are two inches apart. The maximum pressure is attained even with the slowest burning powder before the third wire is cut, so that only two spaces of time are measured at this important point. If we take into consideration that the pressures may vary very irregularly and very greatly during this part of the action, it will be seen that the difficulty of tracing it must be very great.

The difficulty of determining the pressure by the chronoscope, during the initial stages, is still further increased by the fact that the shot has to move some distance before shearing the first wire, and that no record of time can be obtained between the first moving of the shot and the shearing of the first wire. Any error in assuming the space through which the shot has moved or the velocity it has acquired when passing the first wire, must affect the calculation of the pressure afterwards, up to the point at least where the maximum occurs.

In addition, any uncertain action of the cutters or deflexion of the

sparks, might be sufficient to throw it out, and would not readily be detected because the velocity would be the same at any point, provided the area below the curve of pressure were the same up to that point. There would, however, be a difference in the total time, but, as has been noticed, the chronoscope does not note the time from the first starting of the shot, where the difference mainly arises.

It will be seen by reference to the pressure curves with the 8-inch gun, how closely the pebble curve would approximate to that of the prismatic, were the density increased so as to make the combustion slower at the commencement, and if this increase of density had also the effect of making the ignition more perfect, and the combustion afterwards more rapid. Density is considered by some as the most, if not the only important element to be considered in the manufacture of powder for very heavy guns.

From a consideration of the various principles I have brought forward, I was quite prepared for the manifestation of some very high pressures in the proof of the 35-ton gun. I am indebted to Colonel Miller* for the following particulars of pressures obtained by crushers in the base of the shot:—

Charge	75	100	110	120	130 lbs.
Pressure	17	25·4	31·8	46·3	63·7 tons.
Velocity	1163	1237	1303	1364	1348 f. s.
Length of cartridge ..	22	27½	30	32½	35 inches.

As the crushers in the base of the shot do not usually correspond in their indications with those of any crusher in the gun, a crusher plug was substituted for the vent and the charge fired by electricity. The following results were obtained when the powder was the service pebble, and the tube in the service position of vent:—

Charge.	Velocity.	Vent crusher.	Shot crusher.
120	1300	28·6	40·4
120	1357	20	21·7

Colonel Miller considers from these indications that a powder which will give in charges up to 80 or 90 lbs. a pressure evenly distributed over the powder chamber, is liable to give severe local pressures in such charges as were used with the 35-ton gun. Now the point yet to be determined is how far we can afford to disregard these pressures, for unless we can disregard them, the gun, although undoubtedly the most powerful gun in the world, must either fail to accomplish its intended object, or a new powder must be provided. We may, indeed, advantageously increase the calibre so as to reduce the columns of powder and shot; but alterations of this description with such a very heavy gun, entail considerable expense, and may perhaps be avoided by a systematic series of experiments beforehand to determine not only the best sort of powder to be used, but also the weight and calibre of the gun to be adopted.

II. WHAT REMAINS TO BE DONE.

What remains to be done, is therefore to determine with greater

* One of the Committee on Explosives.

certainly the law of pressure during the first part of the shot's motion through the bore, in order that it may be made to approximate as closely as possible to the law of strength of the gun, without running any risk from sudden pressure or anomalous pressures of whatever description. No method of accomplishing this has as yet met with entire success. Rodman's velocimeter failed for want of delicacy. The chronoscope of Captain Noble cannot be relied on for the reasons given. Another attempt was made by General Mayevski, of the Russian artillery, who attached to the base of the shot a rod which he passed through a hole in the breech of the gun. As the shot moved, the end of this rod was made to break two electric currents at varied distances with different rounds. It seems strange that he did not make it trace a curve on a revolving cylinder, for he would thus at least have obtained what is most required, viz., a tracing for a very short space from the very starting-point of the shot. The connecting rod, however, broke, and his results are of no practical importance.*

Particular care must be given to determine, as far as possible, the nature of the anomalous pressures so often referred to, so as to know whether they are due to length of cartridge and position of point of ignition, or to some chemical or physical law. If the former, they may probably be prevented, but if the latter they may be expected to manifest themselves on the attainment and in continuation of some definite pressure, and will have to be avoided.

The experiments, however, will not be complete if they merely tell us what is best adapted to any existing service gun. By a comparison of the results obtained with varied powders, bores, charges, and projectiles, some laws must be established which will enable us to determine beforehand what powder, calibre, charge, and projectile will be best adapted to any contemplated new gun; for, if, when we make a new gun, we have not only to alter the bore, but also the powder, we shall land ourselves in an expenditure of money which will very soon ring the knell of our future monster artillery, and the ships will beat us in the race.

The precise nature of the powder to be adopted is not by any means to be considered as definitely settled. The pebble powder which has been recommended by the Committee has given satisfactory results only as far as the 600-pounder, and there is reason to believe that with the 700-pounder a new description will be required. It is not improbable that it will be found necessary to adopt two sorts of different densities, one of which shall be suitable for the smallest of our heavy guns, and the other for the heaviest. Mixtures in different proportions, it may be conceived, will meet the requirements of the intermediate natures. From past experience we should take a lesson not to rush on too hastily in an old groove, making large quantities of a powder which, though well adapted to present requirements, may soon become obsolete as the art of gun-making advances, for if we do we may again find ourselves

* *Mémoire sur les expériences faites à l'établissement de M. Krupp à Essen au mois de Novembre, 1867, pour déterminer les pressures des gaz de la poudre dans l'âme des bouches à feu, par M. Mayevski, Général Major, Membre du Comité de l'Artillerie Russe, 1869.*

with plenty of powder, but with very little of the precise nature we require.

III. HOW TO DO IT.

The importance of determining the questions I have briefly sketched out, will readily be recognized, but the question may be asked, How are we to do it when so many have failed? We must benefit by the experience of those who have gone before us, and, if possible, improve on it, taking care to avoid their failures. Rodman had a clear idea of how a systematic series of experiments ought to be carried out when he varied the length of charge, column of shot, and diameter of bore. It is because Mr. Bashforth followed a similar principle when he carried out his experiments with varied bores, charges, and projectile, to determine the resistance of the air, that he has met with such marked success. Had Rodman's pressure-gauges been as accurate and as sensitive to determine pressures as Mr. Bashforth's instrument was to determine time, we should not have had much more to do than accept his conclusions. But Rodman failed for want of an instrument to carry out his ideas. He has, however, shown us what is to be done. Let us but carry out his notions on the plan laid down by him, and we shall obtain results which will well repay a little trouble and some expense.

It would be necessary to have experimental guns of the strongest possible form of construction, and of varied calibres, say 3, 5, 7, 9, and, possibly, 11 inches.

Pebble powder being most likely to give satisfactory results, should first be tried. Density, also, appearing to be the most important element, should first be investigated. Two densities of this powder might be used, 1.74 and 1.84. Commencing with density 1.74, it should be fired first from the 3-inch gun, with varied charges and projectiles, noting the increase of pressure for each increase of charge and each increase of projectile, and taking care to note any manifestation of anomalous pressure.

The same powder should then be tried, in the same manner, with the 5-inch gun, and the pressures noted, with the view to find out whether they increased with the lengths of charge and projectile in the same way as in the 3-inch gun, or at a more rapid rate.

The same should be done with the 7-inch gun, to see if the pressures were the same, or increased at a still more rapid rate, and so on with the 9-inch and 11-inch guns if necessary.

Density 1.84 should be tried in a similar manner, and in all probability will show that the pressures are less under similar circumstances, and that longer columns of powder and shot can be fired with this powder than with density 1.74.

Any other density can be tried, if necessary, in order more satisfactorily to elucidate the allowability of increase in column of powder and projectile with increase of density.

If equal columns of powder and projectile in all the guns give similar pressures, then the size of gun for any particular density of powder will be given by the length of the columns, but, if not, a modification must be made according to the influence of the size of the bore on the

pressure. In the latter case much light will be thrown on the relative values of big and small bores, especially if taken in connection with the known laws of the resistance of the air and the penetration of armour plates.

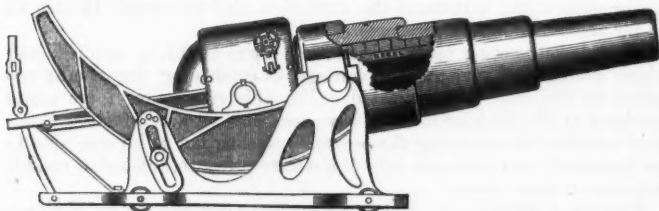
In this manner we shall not only be able to say what the pressure is with varied charges, calibres, and densities of powder, but we shall be able, from the laws which may be established, to calculate with tolerable accuracy what will be the pressures with larger charges and bigger guns, and what density of powder is suitable for each.

Lastly, having fixed certain densities which are to be manufactured, and what guns they are suitable for, we may, if thought advisable, make some experiments to determine what mixture of these densities would give better results with intermediate guns.

This method of proceeding is founded on the supposition that density will not fail us, but it may not be all that we require. If it fail us other methods of regulating and moderating the combustion of gunpowder might be tried.

It is possible that with our heaviest guns we may have not only to search for the very best description of powder, but also for the very best description of gun. We can obtain some very good practical information to guide us in fixing what is the maximum pressure which it is safe to use, for, by firing the battering charges of our service guns in these experimental guns, we can note the pressure given, and adopt that as the maximum, which must not be exceeded in any new gun of similar construction.*

I am indebted to Mr. Bashforth† for the suggestion that a gun with a moveable breech, on the plan proposed by me a year ago,‡ would be the best means of carrying out these experiments. I may observe that of late I have very much improved its construction, my object being to allow the breech to move right away, so as not to disturb the elevation. In this way there would be no shock on the carriage, and, with a 15-inch gun firing at 15° elevation, the strain would be reduced from 1,000 tons to 100 tons at most. This enormous reduction of strain would make it exceedingly well adapted to the small gun-boats now being constructed to carry heavy guns on platforms, which can be raised or lowered at will, on the plan invented by Mr. Rendel, of the firm‡ of



* Some very valuable information could also be obtained during these experiments, by firing through the Bashforth chronograph, which would show the amount of steadiness given to varied lengths of projectile with varied velocities.

† Professor of Applied Mathematics to the Advanced Class of Artillery Officers.

‡ Vol. xiv. p. 479.

Sir W. G. Armstrong and Co. Fig. 11 shows an elevation of the gun. The breech is run home on the guide bars, and thus the hollow part of the curve is thus bridged over.*

For the general law of pressure throughout the bore the gun could be used in the form shown, for the slipping away of the breech without resistance would give an accurate measure of the pressure which impelled it. It would have four times the delicacy of Rodman's velocimeter, because the space it would move would be more than three inches while the shot traversed the bore. It would have this great advantage over Captain Noble's chronoscope, that the tracing which could be obtained from it on a revolving cylinder would be a continuous curve from the very starting of the shot, and not merely indicated by several points. It would also show the effect of lead-coating and rifling on the pressure.

But the great advantage to be gained by this method would be the possibility of determining exactly the nature of the anomalous pressures. The breech could be reduced in weight to any amount necessary to give the desired sensitiveness, and the pressure could without difficulty be distinctly traced during the first stages of the shot's motion. For this purpose it might be necessary to use a short gun, so as not to get up an extreme velocity. It would even be possible to have breech and projectile of the same weight, and each double the weight of an ordinary shot, and the conditions of pressure would remain very much the same, because the two would move in opposite directions, each with a velocity equal to half that of an ordinary shot. And if the gun were not too long, a record could be obtained from both projectiles. This would be a means of detecting even successive impulses of wave motion, if any such existed in the elastic fluid. It is probable, however, that such extreme delicacy would not be necessary, but that the law of pressure would be so traced during the initial stages as to give us all the information we desire.

But if it were desirable to test enormous pressures, so as to trace Rumford's law as far as possible, this method could be adopted, for, by using a very short column of powder, and two very long columns of shot, the pressure would be very high, but, by virtue of Rodman's law of increase of strength with diminution of length of chamber, our very strong guns would withstand the explosion, and we should be able to go far above Rumford's pressures.

There is yet another use to which such a gun could be applied, and which would be of very great advantage as confirming the results obtained in the way first indicated. For this suggestion I am again indebted to Mr. Bashforth. We have seen how very satisfactory Rumford's method of measuring the pressures was, as far as he was able to go, because it takes account only of absolute pressure, and not of sudden pressure or wave motion.

There is a difficulty in applying Rumford's method to an ordinary gun, because the recoil of the gun would prevent the arrangement of

* A firing model was made for me at Elswick. It was fired several times with 2 oz. charge and 11 oz. of shot, the proportionate proof charge. The action was perfect. There was no escape of gas whatever when a leather gas-check was used.

the heavy weight on the top of the stopper, but in a gun with a moveable breech this difficulty would not occur, because the barrel does not recoil.

If these two methods of measuring the pressure coincide, as I am confident they must, not only on my own mature consideration, but also because they meet the approval of so able and successful an experimenter as Mr. Bashforth, the results might be safely relied on, and laws would be established which would allow of extension, so as to tell with certainty what would be the probable fate of any proposed new gun, and in future we should be able to justify our preference for big or small bores, not by the opinion of any individual, however eminent, but by the invariable laws of science, deduced from experiment. No doubt such experiments would require a considerable expenditure of public money, but if we go on with big guns, as go on with big guns we must, they will result in a gigantic economy; and, if these investigations were combined with what we already know, and what yet remains to be determined in the other branches of gunnery, our English artillery would, as heretofore, maintain its position as the first in the world.

Ebening Meeting.

Monday, March 20th, 1871.

REAR-ADMIRAL A. P. RYDER, in the Chair.

NAMES OF MEMBERS who joined the Institution between the 13th and 20th March, 1871.

LIFE.

Elliot, Hon. William Fitzwilliam, Lieut. 93rd Highlanders.

ANNUAL.

Bros, R. Follett, Captain 2nd Battalion 17th Regiment.

THE PRELIMINARY EDUCATION OF NAVAL OFFICERS.

By Captain JAMES G. GOODENOUGH, R.N.

I HAVE been asked to offer to the members of this Institution, and through this Institution to the Naval Service, by means of our very useful "Journal," some remarks on Preliminary Naval Education. They are the results of many years' observation, and of much thought on the training of Naval Officers, in the course of my service in the largest ships of Her Majesty's Navy, during which time I have become convinced of the necessity of our providing a much more careful and methodical course of instruction for our Officers than now exists or has before existed.

I have undertaken my task with some diffidence, but with the assurance of the kind disposition of my brother Officers to listen to the ideas which have occurred to me, and to the facts which I can put before them, though ill strung together, trusting that they will connect them and argue from them in better fashion than I can pretend to do. Engaged, as I have been, in the active and practical performance of duties afloat for many years, I do not pretend to read such a paper as I can conceive might be offered to you on this subject by those who have studied the machinery of teaching, and are acquainted with the ascertained results of modern instruction in actual schools. Still perhaps, I may have some knowledge of what results we ourselves obtain, and I may have been able to estimate better than many others, the effect of our own recent changes, and of still more recent proposals, which I intend to

examine; for, having been convinced from a very early period of my career, that there was occasion to introduce more *method* into our system of education, and to leave less to the chapter of accidents, and to the individual and often ill-directed efforts of the few who emerge from the mass of the possessors of mere superficial knowledge, I have naturally been confirmed and strengthened in my early views, the progress and inventions of the last twenty-five years having tended materially to methodize the practice of navigation, and the management of ships-of-war. I do not expect to convince any one off-hand of the accuracy of my judgment in the matter. My wish is chiefly to excite thought and examination of the subject, and to evoke free discussion, not only here in this theatre, but in the journals and periodical publications of the profession, for I am of those who believe that more good than harm is to be attained by the discussion of most professional subjects, and that the power which exists in all military services of suppressing or forbidding such discussions, should be exercised most sparingly and patiently.

I do not propose to touch on the history of naval education, nor to explain the systems now in force in foreign countries. The one has been done briefly and usefully in the Appendix to the "Report of the Committee on the Higher Education of Naval Officers;" and the other has been explained by Captain Harris in his historical sketch of the education of Naval Officers, as well as more recently by Captain Charles Hope in the pages of "Blackwood's Magazine."

Neither shall I further allude to the proposals of other Officers.

There must have been, no doubt, from time to time, not only communications of interest from Officers in command of ships or stations, but also minutes thereupon by the Lords Commissioners of the Admiralty, which would contribute to our knowledge of the past; but these I have not seen, though there must be something of the sort existing.

I should be guilty of an absurd and forced indifference to what is passing around me, if I were not to say that an impression now exists very generally in the service, that the view which finds most favour with regard to the training of Officers for Her Majesty's Navy is, that the Naval Officer should be caught young, that he should be made to devote himself to the details and nothing but details of his profession from boyhood to youth, and from youth to middle age, and that somewhere between middle age and old age, he should be deemed to be worn out and be thrown away a pensioner on the country's gratitude; unfit even to have a voice in the guidance of the affairs of the service to which he may have been an ornament.

I say that such is the impression abroad, and I entreat those who can show that it is not so, and who can contribute to remove such to aid in doing so, for such an impression is doing much harm in all directions.

It is weakening the desire for knowledge and self-improvement in naval Officers; it is tending to narrow and circumscribe the idea of responsibility of a naval Commander for all things coming within his ken, and to lower his conception of his own position from that of a

representative of his country in all parts of the world, an agent of her policy, and a guardian of her commerce, to that of being a mere executive tool, whose only argument is force.

The naval reputation of this country has not been achieved by men who held so mutilated a notion of their duty as to be the mere executioners of their country's judgments. I believe that I may boldly say that we have scarcely a man in our naval history, distinguished as a naval Commander in action, who has not also been distinguished in some other pursuit, professional or otherwise, practical or scientific; but, if we continue to acquiesce in the meagre education which is at present permitted to naval Officers, we must resign ourselves to the position of a Chinese military mandarin, to be at the beck and call of civilians and consuls in time of peace, and to be hustled and forced into perpetual mistakes in war. I would therefore here give a word of encouragement to those who have felt the chill which is given by the indifference to individual exertion out of the main line of routine, of a continually narrowing departmental system. I would say, don't be afraid of discouragement in following up any line of study which your taste leads you to choose. Nothing prevents your taste and your study from running side by side. Nothing that you can learn will come amiss to you in your profession. Nothing which you learn can be useless to you. More than this. If you wish to serve your country as a Commander of any force, great or small, you *must* nourish yourself by study. Opportunities come in vain to men who are unprepared. No visible smile may encourage you, but *le ciel t'aidera*. Your day will come. The Danes always land *pour qui sçait attendre*. Above all, don't fancy that the *men* of the department of Government under which you serve are against you. The tendency of a departmental system is stronger than the *men*, and *they* in many things are as much chilled and bound by it as *you* may fancy yourself to be. You are only *chilled* by its influence now. One day you may be bound by it also, until the day when the general spread of educated and instructed willing intelligence shall set us free from the bonds of system, while giving us free use of its machinery.

We are often afraid of tying ourselves up too closely by committing ourselves to a system, and some of those who have most desired the advantages of system have feared its restraints, and have recoiled from the results in France. Well, we may all thank the Germans for having solved *that* problem for us, and for showing us that the willing intelligence of the members of an instructed force can use a system without being hampered by it, and are no less free than if they had no system. That simple sentence of Colonel Wright's at once found an echo and made an impression in England, because of the profound truth which it contained.

Now, I don't want to see our country slavishly copy the institutions of any other, but I do wish that effects should be traced back to their real causes.

We are much too apt to hold back for a long time from desirable change, and at last, under pressure or panic, to bolt an innovation whole, without preparing it for our own particular use; and therefore

I say, don't let us bolt either the German, or the American, or French systems whole; neither let us take the best parts of each plan, tack them together and expect them to work well, but let us examine events intelligently and trace results back to their causes.

The warning which I would give, and it contains the whole case, is this,—that while all other circumstances of life at sea have changed considerably in the last thirty years, the preliminary training of our Officers has not changed in its main features.

It is not merely that our *matériel*, whether in ships or guns, steam-engines or canvas, has changed. It is not only that our *matériel* has become far more complicated than of yore. If that alone were the case, the system of a former age might supply the wants of the day. No! the change whose bearing we have failed to acknowledge, even though we may have perceived it, is this, that while formerly the conduct of ships at sea, their discipline, and the handling of their *matériel* generally, was based on the experience obtained in the practice of individual lives from early years, and on an acquaintance with external phenomena and internal details, which were not reduced to laws or elevated into systems; now, we *do* possess rules and laws, which greatly reduce the value, if they do not quite supersede, the practical experience of a single life.

In every one of the varied practical duties of a sea Officer, this is the case, whether in navigation or in discipline, in artillery or in manœuvring; and I say that this constitutes the great change in a sea life to which we have made no corresponding advance. I say that although those laws and systems exist, we still continue to let the details which they include be painfully and only partially acquired by experience, instead of methodically teaching the principles on which they are based.

Such a course not only involves a waste of many years of life, but also burdens the mind with ill-assorted facts. The opposite course educates while it instructs and enlarges the mind to receive much more solid knowledge as well as actually many more facts.

I do not say that there are not, here and there, talented young Officers who have made the most of their time and of special and exceptional opportunities; but I do say that the mass are ill taught in all subjects, and particularly in those exclusively practical and professional ones for which the present system is sought to be retained by many practical Officers.

What I reported to the Lords Commissioners of the Admiralty in June, 1868, I may here quote as illustrating the work now done on board large ships in a squadron. I was transmitting the half-yearly Report of progress of midshipmen, and I furnished tables of the work of the past six months, showing that during that time there were devoted to real methodical teaching an average of—

Hours.	Subject.
7	Mathematics, &c., under Naval Instructor
1.6	Seamanship
1.5	Gunnery exercises

by each junior Officer per week.

And I then said, "That I believed the study in the 'Minotaur' to be closer and less interrupted than any other in the squadron; and that I found the weekly averages to compare favourably with those of the 'Victoria,' my former ship."

I added—and I still retain these opinions—"I wish to express my belief that the opportunities for instruction on board well-regulated ships, have receded instead of advancing during the past 20 years. That while the subjects of study in the profession are less those of observation and experience, such as the management of ships under sail, and more those which are best acquired by systematic teaching, the opportunities for both have diminished.

"Twenty years ago, ships made passages at sea occupying more months than the present ones occupy weeks; and while young Officers were then constantly learning the management of ships under sail by daily observation, their mathematical studies went on with the greatest regularity. In harbour, after the work of refitting, &c., was over, they again returned to a steady plan of instruction.

"At present ships are constantly moving to sea on short trips under steam. The work is entirely changed. The hours that were spent formerly in watching and helping in the working of the ship, are now wasted in seeing ashes thrown overboard and decks swept.

"The most useful work which midshipmen are called on to perform, are those of a petty Officer, viz., visiting look-outs and heaving a log.

"All instruction is frequently suspended in consequence of going in or out of harbour, for general exercises (from which, under the present system, midshipmen should not be absent); and the very branch of knowledge which the present system was supposed to favour, viz., seamanship, is the one for which proper teaching is most wanted;" and in confirmation of this, I may read part of Professor Main's evidence before the Committee on Higher Education of Naval Officers. He says, "In my opinion, in the higher branches of the service, we have more educated, thoughtful, and intelligent men than we shall have among those who are coming on now."

I afterwards cited an actual case, and not an unlikely or an uncommon one, of a Midshipman presenting himself recently before me for examination in seamanship, who had served four years in one ship of a particular class, and had never seen her tacked; and I continued—

"The practice of seamanship must be the subject of systematic teaching, as well as other branches, and can only be taught in that way under present circumstances. This is acknowledged in the case of boys, and singularly disregarded with young Officers."

It is as a comment on this that I repeat what is contained in Professor Main's evidence, for this same Midshipman had also been without a Naval Instructor during his $4\frac{1}{2}$ years.

He says, "I will, if you will allow me, give the opportunities for instruction which Sub-Lieutenants, who passed at the College in February last (1869) had enjoyed. I will not mention names, but I will designate them by letters: Mr. A had had a Naval Instructor, B had not for $4\frac{1}{2}$ years, C served in a gun-boat for the last 18 months, D had a Naval Instructor, E had not had one for nearly 4 years, F

"none for $3\frac{1}{2}$ years, G was 9 months on shore previous to examination, H was 21 months sick, I had no Naval Instructor for 3 years 10 months, K was 2 years without a Naval Instructor, L had had a Naval Instructor, but could not study because in charge of a deck."

Again, in December, 1869, I forwarded tables to the Admiralty, showing similar facts to those exhibited by me in 1868.

An order of the Vice-Admiral commanding the Channel Squadron had in the meantime directed that the Midshipmen should be exempted from some of the general exercises of the squadron, and the total times under instruction under the Naval Instructor in the six months ending December 31, 1869, were increased from 7 hours to 10·6 hours per week.

Each of these letters was accompanied by a comparative statement of the progress of Midshipmen since leaving the "Britannia," as shown at their examination, by which it appeared that the position of Midshipmen at the examinations in mathematics was not in the least governed by their age and length of time at sea, but was in precise proportion to the amount of acquaintance with mathematics which they possessed when they left the "Britannia," so that I reported in the latter letter—

"This number of hours (10·6) is found to be just sufficient to secure a very slight advance in the instruction of Midshipmen in mathematics, while, as I demonstrated in that letter (June, 1868), the former number of hours (7) was just sufficient to enable them to retain what they learnt in the 'Britannia.'"

I may add that this also agrees with what I had found out by similar tables and comparisons in the "Victoria," in the Mediterranean in 1865; and I will, therefore, deal only with the detail of the latter, which shows that—

"Of the 24 Midshipmen now in the 'Minotaur,' of ages varying from $15\frac{1}{4}$ years to $20\frac{3}{4}$ years, the average age of the 12 who have gained most numbers in the last examination is the same as the average age of the 12 last, viz., 17 years, the average age of the

	Years.	months.
1st six being	18	2
2nd "	17	7
3rd "	18	9
4th "	17	0

"By inspection of the Reports of the other ships of the squadron, I perceive that in—

Ships.	No. of Midship- men.	Ages.		Average age.
		Yrs. mths.	Yrs. mths.	
A	24	15 10	to 19 4	First 12 17·3 Last 12 16·7
B	15	15 10	" 20 7	First 7 18·0 Last 7 17·0
C	11	15 11	" 19 2	First 5 18·4 Last 5 16·7
D	17	15 7	" 18 6	First 8 17·4 Last 8 17·0
E	16	15 11	" 21 3	First 8 18·5 Last 8 17·8
Minotaur	24	15 10	" 20 2	First 12 17·0 Last 12 17·0

" These facts show that on a difference of age of four years there is an average difference of progress of but seven months.

" I have spoken above only of results of studies under the Naval Instructors, because progress in those studies can be tested by examination where numbers gained are a measure of progress. In other subjects the test of examination is not so trustworthy, especially for that combination of qualities which form an Officer."

It is on these facts and many others like these, that I condemn our present plan of employment of young Officers. They show a waste, and not only a waste, but a misapplication of time and labour, which is well known and understood by all those who have served recently in a squadron.

They are supplemented by the statement, fully borne out by evidence, in "The Report of the Committee on the Higher Education of Naval Officers," that "the experience of the Flying Squadron shows that the knowledge of young Officers in everything but navigation is in inverse proportion to the time elapsed since leaving the 'Britannia,'" and I confess that I am surprised that that Committee should have been of opinion that the abolition of Naval Instructors, and increased stringency of examinations, could cure this evil, and could extract from young Officers that which they have never had put into them.

The "causes" to which that Committee assign the "comparative failure," to show an advance in mathematics, are—

1. That the final examination at the Royal Naval College gives no sufficient stimulus.

2. That the intermediate examination is not carried out under sufficiently uniform and stringent conditions.

3. That there is incompatibility between the position of an Officer and a school-boy.

And these causes are, no doubt, correctly stated, as far as they go, but I think that with the evidence which the Committee had before them, deeper and more conclusive reasons might have been assigned for

the conspicuous failures which I pointed out in 1866, 1868, and 1869, and which is corroborated by the whole of the oral evidence before the Committee. The first and second reasons given by the Committee are wholly subordinate ones. I contend that neither English Midshipmen, nor English Naval Instructors have been so careless and indolent that examinations can work the miracles which the statement of these causes seems to promise. I, and many others with me, have been too long witnesses to the zeal and attention of Naval Instructors, and to the constant striving with the difficulties of instruction in a service afloat, to agree with the Committee. We know that in trying to promote the instruction of our Midshipmen, whether as Gunnery Lieutenants, Naval Instructors, Commanders, or Captains, we have signally failed to obtain either the time or opportunity we desired, and that we have had to record a constant failure to carry out the most modest programme of any study, in consequence of the loss of time and opportunity which the conflicting duties of a sea-going ship occasion, while we know that the time which we have seen wasted has been wasted in dawdling up and down a deck, and in the veriest frivolities of the course of service.

The third cause given by the Committee, and which rests on the clear and intelligent evidence of Professor Main, is the only one which goes to the root of the matter, and it assigns rightly one cause of the failure of our present plans.

I cannot pass on without examining the Report of this Committee, in so far as it touches on the preliminary training of naval Officers. This paper would be entirely incomplete without making such an examination, before proceeding to state my own proposals for the improvement of the education of our service.

That Report was published on the 8th July, 1870, and I presume that all those who are interested in the subject will have read it. After a close perusal of it, and of the partial Report of the evidence which is attached to it, I am bound to say that in many parts the Report does not rest on that evidence so entirely as to obtain my adherence, nor do I consider the evidence as published to be sufficiently full to give all the desired information to the public, neither can I agree in the assumption with which the Committee set out, on their examination of the state of preliminary education in the English Navy.

Under the head of Comparison of Systems, at Part x, section 7 of the Report, the Committee assume

That "on the other hand the system of entry at an earlier age which, as a rule, has always been the practice in the British Navy, insures the obtaining a supply of young Officers at a time when, their minds being plastic and docile, and their habits and modes of thought yet unformed, they can be more easily inured to the peculiar habits of a sea life, be more accustomed to its unavoidable privations and occasional hardships, be trained up in attachment to their profession, and be induced to adopt it heartily as their vocation in life. Early entry into the service is therefore associated with all the traditions of the Navy, is in accordance with its historical recollections, and is in unison with the general tone of professional feeling on the subject," The

opinion given in this assumption is so authoritatively stated, and lies so completely at the root of all the opposition to extension of naval education, that it should be narrowly examined, and should not be accepted as fact without proof.

My own conviction is entirely opposed to every part of it, and I have therefore searched the evidence in the Appendix to the Committee's Report, for the foundation whereon this opinion, which is the key to all that the Committee say on preliminary education, rests.

In my search I have not been more successful than the Secretary to the Committee. He appends to this paragraph the support of but two witnesses, one being our Naval Attaché to the Embassy in Paris, who has not served afloat for 12 years, and the other a distinguished Commodore, whose opinion would be of great weight, were it anything more than a vague one, modified by subsequent answers to further questions.

Not more than four other witnesses at all alluded to the age of entry into Her Majesty's Navy, although the fact of early entry is held by the Committee to be the main reason for the need of the higher education, which they were ordered to inquire into, and I think that I shall only be assigning a proper value to their assumption when I say that it is merely an opinion of the majority, in a Committee of six members.

It is obvious that the Committee, by the assumptions of this section, give a strong approval of the home and private education of English boys, and as strongly condemn that which they receive at a higher age—generally at a public school—and I am therefore impelled to ask if their opinion is sustained by facts? Is it a fact that the education received at large or public schools is such as to make boys less docile or plastic than is consistent with their adoption of a profession of hardship? Is the habit or mode of thought which is formed at a public school an opposite one to that demanded by the naval career, or incompatible with it? Are the peculiar habits, the unavoidable privations, and the occasional hardships such as to turn the stomach of a public school boy? Is the age of 17 or 18 too late for a reasonable, educated lad to accept and attach himself to a career which combines much enterprise and interest with a service of honour?

And, finally, while "early entry into the service" is no doubt associated with its history and "traditions," is it in unison with the general tone of professional feeling on the subject?

I offer these enquiries in the belief that the Committee are entirely in error in their assumptions, but with a wish that they may be examined and discussed. To me they appear to involve a misapprehension, both of the naval profession, and also of the character of the English public schoolboy; and, while the Committee assume that the naval service is not one to which a reasonable youth would willingly attach himself, I believe it to be one which gives to an educated man opportunities for the development of all his powers and interests for his whole life.

It is quite unnecessary for me to answer the first four of these enquiries. The answers to them are in the knowledge and experience of most Englishmen; but I may draw attention to the view adopted by the

Royal Commission on Military Education, who, when they speak in their Report of the docility which it is wished to retain in young Officers, expressly state that "the early dawn of manhood is the period of life "at which the disposition is most docile, a professional aptitude most "readily acquired, and habits of obedience and a due appreciation of "the necessity for discipline is most cheerfully recognized," the early dawn of manhood being put at 17 years of age and upwards to 20 years, and this common-sense opinion is the one which I think we shall accept, instead of that of the Committee. To the last question I may say that I do not think that the Committee made sufficient enquiry on this point among all ranks before making their Report, and that as it stands, it has only the value which can be given to it by a majority of a Committee of six members.

I must further observe that in point of fact this entry at an early age is quite thrown overboard by the Committee, in their recommendations or suggestions, at Part xi, section 9. The age at which youngsters are to be entered in the training-ship is not there stated, but supposing 12-13 to be meant, according to the Admiralty Circular of January, 1870, the age at which the boy is to go to the seagoing training-ship is to be from 15 to 16, and there he still remains, a schoolboy, till he commences on that career for which early entry is supposed to be so beneficial, at 16-17, an age, let us remember, at which the Committee expects the young Officer to have sufficient independence to get on alone with his mathematical and other studies.

And, before quitting the subject, let us remember that this early entry, which is supposed to be necessary for the Officer, has long been abandoned for the seaman. The second-class boy first appears in a training-ship, at the age of from 15 to 16½, and goes to sea in a seagoing ship, at from 16½ to 17½, after a most complete training, which has made him comparatively much superior to the young Officer, his cotemporary, who is to command him.

Turning now to the circular of January, 1870, which may be examined side by side with the Committee's scheme, as the Committee seem to intend that the age of entry shall be the same as that of the present regulation, I ask, Wherein do the first two years passed under either plan, differ from two years passed at a public school,—viewed as a preparation for a sea-life,—beyond the fact, that the boys passed into the service live within wooden walls, under low decks, and sleep in hammocks close under beams, both of which circumstances must ultimately be unfavourable to health; and also, that being surrounded by water, they get a good deal of exercise in boats? And, I ask, wherein does the plan of the sea-going training-ship differ from any other seagoing ship, except that the hours are rather more regular, and the routine rather better shaped than it can be in a ship forming part of a squadron?

The one element of good which appears in the Committee's scheme, is the establishment of the third year's training with practical work in brigs during summer. But, as this additional year is to compensate for the midshipmen being entirely left to themselves for from 3½ to 4 years, I must cry out against such a proposal, as I perfectly remember

my own position at about the age at which the Committee propose to leave boys to themselves.

For four years I had sailed in one of the best ships of her time,—the “Collingwood,”—and at the age of 17 I was sent for 18 months to the Coast of Africa, in a paddle-wheel steam frigate. In spite of the good wishes of an excellent Captain, I well remember how completely that year and a-half was lost to me, for want of assistance in studies of all sorts, and for want of a definite direction to them.

Some of the best witnesses before the Committee have said that at the age of 16–17 it will be a boy's “own fault if he does not get on “by himself; the responsibility will then be thrown upon themselves.” That “young fellows have done it.” “Youngsters ought to keep up “their work under the six-monthly examination system,” and that “it is thought that boys of 16 really might quite well keep on their “studies themselves.” But yet with the highest respect for Professor Main, and Messrs. Tompkins and Laughton, I must say that there is nothing in their experience which warrants such hopes. The context of their evidence rather shows that in their condemnation of the present system, in their despair of obtaining reasonable results for the naval instructor's time, pay, and trouble now wasted in a sea-going ship, they hoped against hope, for some exceptional mathematical geniuses amongst those whom they wish to see better grounded than at present, under a future four years' system of mathematical training.

This part of their evidence is, I venture to say, contrary to all practical experience. Examinations will do much, no doubt, to stimulate, and they are valuable above all in exhibiting the truth, but they cannot teach, and they will not alter the routine of a ship to make time to work in.

I think that the whole of the evidence, and the whole of what I have before said, shows that it is impossible to have any really connected study of any part of our profession when following the desultory routine of a sea-going man of war in the ordinary service of the Fleet.

Well! one need not read far in this Report to see that what has been called preliminary education was the stumbling-block which not only the Committee, but every witness also, felt to lie in the way of attempts at higher education, and the Committee would have rendered service if they had stated this plainly in their Report and had recommended early inquiry into the subject. As it is, they have made partial remarks on preliminary education, partially supported by evidence, and have even left out some of the evidence which was offered to them. I think we shall agree that, under such circumstances, we may wish for renewed deliberation, and we shall regret that the new plan of study in the “Britannia” was not preceded by some inquiry among practical persons.

I shall not go into great detail in explaining my own proposals for preliminary education and training of naval Officers. I shall only point out the principal features of my proposals and leave the details to be filled up by those who have a closer experience of schools than I have. The principles on which I consider that that education should

rest are these:—First, that a distinction should be made between the period of education and that of special training. Second, that special training should be the business of the Government, while education should be left to the care of the parents, at the ordinary schools of the country. Thirdly, that the handling of ships' sails and boats and the principles of command should be methodically taught, instead of, as at present, being left to chance observations and the accidents of service. Fourthly, that the young Officers under training in school ships should have no command, except over each other, and should count no sea time; and that on entering the service afloat in sea-going ships they should become at once, in some measure, responsible Officers, though liable to future examinations, and to produce evidence of having done work after leaving the training-ships. Fifthly, that in order to discourage cramming, all entrance examinations should be confined, as far as possible, to the subjects of study at advanced public schools, and that every candidate should be required to bring with him certificates of a year's good conduct from his last school.

I wish to see a distinction made between the education and the special training of naval Officers. I do not pretend to fix the precise age at which this distinction should be made. It will necessarily differ with different boys, and I would therefore have a two years' limit to the age of entry instead of one. My own opinion is, that special training should begin at from 14 to 16, and that it should be continued from that age for three years, that is, from an average of 15 to an average of 18 in college and seagoing training-ships.

I should wish young Officers to proceed thence to the ordinary service afloat, and after two years' service in a sea-going ship to be admitted to pass an examination for Lieutenants.

You will remember that, at present, we enter young gentlemen at from 12 to 13, and that we carry on their education for two years, whereas I propose that that education should be given at the general schools of the country, and at their own expense. You will remember that there is nothing of the professional life in those two years now passed in the "Britannia." Why, then, I ask, is it necessary for the Government to undertake the work of education as distinguished from special training?

Are the schools of this country so bad? Is it that their course of instruction is so ill suited to modern aims as to make it necessary to set up a model Government establishment? I think not. I believe that a Government school cannot in the long run compete in this country with our public schools; and therefore I wish to see the work of education accomplished before the Government begins that of special training. I do not complain of the course pursued in the "Britannia." I can testify to the high spirit and to the good discipline of boys who have passed through her. But I do regret the loss of individuality which is inevitable when all young gentlemen are passed through the same course from the age of 12 years. The evidence of Captain Sherard Osborn is material on this point. As an Officer of eminence and of distinguished merit in our profession, as a man of varied experience of the world, and an instance of most successful self-culture, I attach great value to his

opinion, and I find that he advocates early education apart from special training, and he deprecates the loss of individuality which ensues from long-continued running in the same groove.

We find that while the course of instruction in the "Britannia" does more for the special instruction of midshipmen in mathematics and elements of nautical science than a regular school education would do, and fits him better for examination, it educates him less well for command hereafter. It tends to sacrifice solidity to quickness, and to encourage the cramming which it has been the intention of the Government to suppress.

The examination for entry, which, under the system which I propose, would be at the average age of 15, should take place in November of each year, and should be arranged, as far as possible, so as to comprise subjects which do not require special cramming, but are taught generally in our public schools, omitting some, such as Greek, of which no further use or notice would be made in their future career, and substituting French, for instance, or another modern language in lieu.

The College would then open for the cadets on the 1st of February, and while indoor studies of navigation, nautical astronomy, and modern languages occupied the mornings, the afternoons should be devoted to practical seamanship until the 1st of May, when they should embark in a corvette especially set apart for their instruction, until August.

During these four months they should perform every practical duty of their profession with their own hands, under instruction, with plenty of time, and with patient, steady instructors, and at the end of their cruise, after an inspection by the Governor of the College, they should strip and clear their vessel before proceeding on a summer holiday.

During the cruise, they should not only learn to take and work their own observations for the position of the ship by the ordinary known methods, but should also study the pilotage of the coast of England, whenever visited.

After the vacation they should again rig their vessel, and until the end of October should have instruction in rigging, masting, and so on, while the weather permitted, as well as continuing to exercise in boats, November and December being devoted to indoor studies and examination.

This would complete the first year of training.

The second year would begin as the first, with indoor studies in the morning, the advanced seamanship class of the afternoon, alternating with gunnery instruction classes until May, when the second class would embark in a steam corvette, and in addition to the study of seamanship, as in the first year, would join that of steam machinery. While the cruise of the first year would have been on board a sailing corvette, and on the south coast of England generally, that of the second year should be extended to the coasts of the United Kingdom and western coast of Europe; and while the sailing corvette should be manned by steady old seamen, and no attempt should be made at quickness of manœuvre, the steam corvette for the second year should be manned by active young trained able seamen, and all manœuvres

should be performed together, as in actual practice in men-of-war, the young cadets under training working a mast.

At the end of this cruize, they would not only strip their vessel, but would also take to pieces the principal parts of the machinery, before the summer holidays and after inspection.

On recommencement of term in October, indoor studies should again be taken up, and the final examinations for the rank of Midshipman should take place in December, the average age of the young Officers being now 17 years.

I should now reassemble the Midshipmen on February 1st, either on board the gunnery ships or in a special ship attached to the college, for a three months' course in practical gunnery, after being examined in which they should be discharged into a full rigged, full manned frigate for final instruction in the duties of an Officer, under selected Captains, Commanders, and Lieutenants. They should here alternately take the duties of Officers of tops, Officers of boats, Officers in charge of a particular mast, and in rotation as Officer of the watch under the care and guidance of a Lieutenant of each watch, while lectures and exercise in manœuvres of ships and boats, of heavy and field guns, of small arm drills and landing parties, should be systematically taught them.

At the end of this cruize, which should extend to the Mediterranean, an examination in seamanship should take place, and the Midshipmen would be discharged into the service afloat, at an average age of 18 years, where they would serve as Midshipmen for one year before examination (as now) for Sub-Lieutenants.

Thus, the whole course of training would be two years at College and in training corvettes as Cadets. One year's training in practical gunnery, and instruction as an Officer in various duties, with the rank of Midshipman, one year afloat in a ship of the fleet as Midshipman, performing all the duties of a subordinate Officer, at the conclusion of which an examination should take place in all the subjects of the profession, whether at home or abroad.

My scheme for preliminary education here properly ends, but I should give an incomplete idea of what I think desirable, were I to omit saying that the modification of the navigating class, the creation of an examination for the rank of Lieutenant, and other changes in ranks, are necessary corollaries to my scheme.

For this course would be required, supposing 74 entries to be made in the year as now, besides a suitable college, observatory, model- and lecture-room, with boathouses, grounds, &c.,

One large hulk,
Two sailing corvettes,
Two steam corvettes,
One steam-tug and tender;

And the following Officers and professors :—

One Captain,
Four Commanders,
Eight Lieutenants,
One Chief Engineer,

Three Engineers,
Professors of Mathematics,
" Modern Languages,
" Nautical Astronomy,
Masters of Drawing,
" Fencing,

And their assistants, according to the number of students at the College.

This scheme will therefore very closely resemble that put forward by Captain Hope, in "Blackwood's Magazine" some years ago, except that so far as I can see, he makes no especial mention of the age of entry, an all-important omission, which I consider the kernel of the whole question; and which I regret that Captain Hope did not fully discuss at that time, as we should have been so much further advanced than we are to-day in our knowledge of the opinions of leading men of our Service.

For myself, I may sum up by stating the present position of Naval education as being entirely unsatisfactory, and I am filled with apprehension for the future leadership of our fleets.

I look on the question as a whole. I do not think of what means are best to give us smart Midshipmen or clever Lieutenants, but which system is to give us good leaders and Commanders of ships and men.

I find that we do get smart Midshipmen out of the "Britannia," now. I find that, as a rule, they deteriorate every year until their examinations are passed; I observe that they then, under the influence of the stimulus and the regular study incident to their examinations, do greatly improve; but we are told that the experience of Captains of ships in large squadrons has not enabled them to trust, as they once did, to the Officers of their watches.

On the other hand, I have the testimony of several American Officers of the highest rank in approval of their present system with which you are acquainted, and which provides for a course of training not dissimilar to that which I have roughly sketched above.

I have said before that I do not complain of the course pursued in the "Britannia," regard being had to the Admiralty regulation as to age, and that I can testify to the high spirit and good discipline of boys who have passed through her; and I then spoke especially of those who were brought up under the regulation in force 18 months ago. I might have said more than that. The management of the "Britannia" is a credit to everyone concerned in her, and I have it on excellent authority that she compares most favourably with our best public schools of equal size.

It was abundantly proved at a very critical moment by a former private secretary to the First Lord of the Admiralty, to whom our service is more indebted than it is at all aware, for the preservation of such slender means of education as we possess, and who is in his own person a living illustration of my argument in favour of high culture of a naval Commander; that, in the estimation of all the Captains in command of ships at a particular time, with but one exception, the

Midshipmen brought up in the "Britannia" were superior to those who had preceded them.

It is believed by those Officers who had an opportunity of judging between the boys of the old College and those who immediately succeeded them, that the system under which they were brought up, faulty as it was, was superior to that which came into force when the College was destroyed.

I think it possible too that the midshipmen produced by the "Britannia" under the new regulation of January, 1870, will be sharper and better taught as midshipmen, though I am sure that they will be inferior as Lieutenants, Commanders, and Captains. The reduction of age, which constitutes the chief feature of that regulation, I look on as an unmixed evil.

But, as the work is now so well carried on in the "Britannia," it would probably be better to change gradually to the system which I recommend rather than by a sudden change to dislocate the present from the future, and set a new generation of Officers in a position which would be rather antagonistic to that of their predecessors.

Conclusion.

I should have nothing further to say, and I should now hope for a free discussion of my paper; but that while I was occupied in compiling it, I became aware that some Officers, whose standing entitles them to be heard, are still opposed to the very idea of improving the education of naval Officers, and are satisfied with the existing condition of ignorance under which young Officers come to sea-going ships. This discovery could not alter my own views; but I am in consequence obliged to notice it, and to anticipate the remarks which may be made outside if not within the walls of this Institution. I may say that I was not prepared for this discovery. I did *not* believe that any persons whose opinions were entitled to credit held such a belief. I could not understand that the ignorance of the laws of hydrostatics, which even now totally obscures the cause of the loss of the "Captain" from most naval Officers, could be acquiesced in. I did *not* believe that the ignorance of foreign languages, which prevailed and was revealed on the interchange of visits of the French and English Fleets in 1865, would be excused, or that the thick darkness which hides from most naval minds the history of our country, and even the elements of physical geography, could still be tolerated.

I have been told that it is not desirable to make the Navy a scientific service. Science, indeed! we are far from that! We are safe enough from any danger of that sort. I only wish for such an education and training as shall enable our Officers to understand a few elements of the laws by which their ships float and move and are guided; such an education as will secure them from asking for the impossible in a ship, while it prepares them to comprehend the simple phenomena and acts of nature, and such a training as will enable them to discharge efficiently the routine duties of their profession, and to maintain an ascendancy over those they will be called on to command.

Look at some of the Reports on experimental ships; see how faulty is the acquaintance with the elements of mechanics which is therein revealed. Listen to the discussion in a ward-room mess or round the College fire, if you do not yet know how entirely superficial, and for the most part untrue, are the notions of stability and buoyancy, the principles of power and leverage, the ideas of strength and quality of materials in daily use, and such like subjects!

Give to two Officers of good repute a simple piece of work to do, and see how entirely they are guided by a rule of thumb, and how different are the proportions of strength of material which they will employ in their work!

Let us ask ourselves how many Commanders and Lieutenants would know what is meant by Buys Ballot's law; or how they would steer their ship so as to increase their atmospheric pressure when expecting a gale off the coast of Ireland!

Don't suppose that I speak of science. I speak of things which concern the safe navigation, or at least the economic navigation of ships. I speak of the bare elements, and not of any deep scientific acquirement. And if I go a hair's breadth away from practical professional topics, I may ask what is the knowledge of military law; what is the knowledge of the leading principles of the rules of evidence; what of political geography; what of our own mercantile marine; what of maritime law? I leave these questions to be thought over by those who have sat as members of a court-martial—by those who have found themselves the servant of a Consul at some unexpected political crisis, or who have been face to face with mutinous merchant ships. It is then too late to look into the elements which should have been acquired in youth, and for want of which the gravest errors are often committed in judging of facts presented to our notice. May I repeat what I wrote to the Admiral commanding the Channel Squadron in July, 1869:—"Much, I do not fear to say most, of the practical incidents of "naval life falling under young Officers' notice, are lost to them for the "want of due early preparation, and thus their practical training "suffers at the same time that they feel themselves (as I, in common "with many other naval Officers, have frequently felt) unable to cope "with many of the questions coming before them, at home and abroad, "in the course of their service."

There remains one other remark or objection to be noticed in anticipation of discussion, or of assertions that we are better than our neighbours.

When in conversation with the Private Secretary to a late First Lord of the Admiralty, I was told, in answer to my assertion that our Officers compared ill with those of the American or French Navies, that our ships were in better order than the French, and that that was a sufficient proof that we were better as we were. Had my interlocutor not been a man of considerable ability, who has shown in his own career that a practical Officer is improved by study and by what is called book-learning, I should not have thought it necessary to show that in his reply no account is taken of our position as an insular people, whose increasing population is irresistibly pushed either to

emigration or to a seafaring life, that consequently, and also by the excellent training of our boys, our seamen are greatly superior either to the French or to the American. Also, that no account whatever is taken of the fact that hitherto, with lavish expenditure, we have kept the number of our Officers very much larger than our needs in peace, and that there has consequently been an immense stimulus to exertion, as well as a gigantic field from which to select the best Officers for command.

Again, that the interests of our commerce, as well as of our colonies, give more continual employment and more constant movement to our ships than to those of the French or those of the United States.

I did not ask him, as I might, to compare the state of our whole Fleet with that of the French in 1854. That would have been a true test of the value of systematically trained Officers.

These are arguments which seem to me a complete reply to that statement, and yet I would prefer not to rest alone on argument drawn from comparison with other services. Without comparisons, we can, I think, intelligently examine our position and ascertain what will make us a better and stronger defence to our country than we have been before. Rather than rest alone on that comparison, I would adduce evidence like that which has been produced in this theatre in an excellent paper by Mr. Edwin Chadwick.* I ought not to trespass on your time by quoting from his paper, but a fresh perusal of his remarks may be instructive. I also commend his notes of evidence given by Non-Commissioned Officers to the "Commission of Enquiry" into "the labours of young persons in factories;" and I say that what is there said of the seaman applies in stronger degree to the Officer.

One word more, and an important one. I assert from my experience that the want of education and training of our Officers, for both are defective, is a hindrance to discipline, and a cause of continual complaints, not only on account of the mixture of the school boy and Officer, but also for want of a superiority of the Officer over the man corresponding to his official and social position.

It has been well observed, that "It is hard to say whether or when "our countrymen will be fully alive to the advantage they derive from "consummate means of naval defence, combined with our position as "islands. Our lot would perhaps be too much favoured if we possessed "together with such advantages, a full sense of what they are.

"The chief of these advantages is the possession of an overflowing "population, unsurpassed as a whole in its energies and endowments," who have recourse to a seafaring life from predilection, and of whom a portion have been so well trained as seamen in the Navy, that they are sought after for all sorts of employments and places of trust ashore and afloat, at the end of their service. To command these men, the best blood of our country enters with ardour into competition. Shall that ardour and those endowments be denied cultivation, and be suffered to follow the schoolboy impulse for emancipation from study, because of historical recollections, and for a baseless phantom of professional prejudice?

* See Journal, vol. xiv, page 287, *et seq.*

Are we who go down to the sea in ships, and occupy our business in great waters, are we alone of all men, only to "see the works of the " Lord, and His wonders in the deep," and not to comprehend them? Are we alone by reason of our isolation when on service, and our want of preparation before it, to be debarred from examining, reasoning on, and enjoying the wonders of nature, and the diversity and infinity of creation?

Can we be right in allowing so much endowment and so many well formed minds to lie fallow for so long?

All reason, all analogy is against it, and sooner or later the intelligent opinion of this country will dictate to our Service what it requires of us. I wish to be before-hand with the country. I do not wish for that dictation, and to avoid being forced into much that I should not approve, I wish to effect our reforms from within, being confident that that character which I love, and which has been described by a great statesman as the noblest and finest this country can produce, will be enriched by culture, and reinvigorated and nerved by mental discipline, and thus be fitted to render as deep and lasting services to our country as those of the great seamen who have gone before us.

The CHAIRMAN: If any gentleman wishes to make any remarks upon the paper which has just been read, now is the opportunity. I may say, with Captain Goodenough's permission, that I drew up a series of questions, thinking they might be of some assistance to those who have not had the opportunity of reading the paper. They are the debateable points in the paper, which, perhaps, gentleman may choose to avail themselves of; but it will be understood that the discussion will not be restricted to them.

The following are the questions referred to:—

I. Does it require now much more than in previous years, that young Officers should receive careful, special, systematic instruction in seamanship?

II. Are these special subjects connected with the naval profession, such as mechanics, gunnery, steam, meteorology, modern languages, with which in a greater or less degree young Officers should be familiarly and intimately acquainted before they can be considered efficient sub-lieutenants, which rank is generally held from the age of 19 to 22?

III. Ought general culture, seeing what progress has been made in it of late years in all ranks of society, to be expected in naval Officers?

IV. Are the years included between 13 and 19 those during which the foundation of the above subjects can be best laid and the superstructure commenced?

V. Can these foundations be laid, or any sufficient progress made in cruising men-of-war, on ordinary service, such as the Channel Fleet or the Mediterranean squadron?

VI. If 19 is the latest age to which the young Officer's career as a subordinate Officer more or less under instruction should be extended, how can the previous six years, viz., from 13 to 19, be best spent, so as to ensure that in addition to Officers being made as thorough seamen as possible (as a *sine quâ non*), they shall also acquire the other branches of knowledge now considered essential?

VII. Is it generally admitted by educated Englishmen that an English public school affords the best known training for boys?

VIII. Does the arrangement indicated in column 5 of the following table, recommend itself as suitable to the changed circumstances of the Royal Navy, changed as it is from its state 30 years since, when seamanship (easily taught in long sea voyages under sail) and practical navigation, were all that were required or expected at the examination of a lieutenant's commission?

TABLE A.
HOW THE YEARS BETWEEN 12 AND 19 HAVE BEEN SPENT.

For twenty years previous to Britannia.	After Britannia established.	After Britannia established. 1867 to 1870.	After Britannia established, 1870. Now in force.	Proposed by Captain Goodenough, R.N.
12	12 } School.	12 } School.	12 } School.	12 } Public School.
13	13 } School.	13 } School.	13 } School.	13 } Public School.
14	14 } Britannia.	14 } Britannia.	14 } Britannia.	14 } Public School.
15	15 } Britannia.	15 } Britannia.	15 } Britannia.	15 } Public School.
16	16 } Sea-going Men-of-War.	16 } Sea Training ship.	16 } Sea Training ship.	16 } Training ships.
17	17 } Sea-going Men-of-War.	17 } Sea-going Men-of-War.	17 } Sea-going Men-of-War.	17 } Training ships.
18	18 } Sea-going Men-of-War.	18 } Sea-going Men-of-War.	18 } Sea-going Men-of-War.	18 } Training ships.
19	19 } Sea-going Men-of-War.	19 } Sea-going Men-of-War.	19 } Sea-going Men-of-War.	19 } Sea-going Men-of-War.

Vice-Admiral HALSTED: If I rise now, it is only for the purpose of stimulating my betters.

Captain R. A. E. SCOTT, R.N.: It may be as well to take the questions on the board *seriatim*. Captain Goodenough asks, do young Officers require at the present time special systematic instruction in seamanship? There can be no doubt that they do, for the seamanship of the present time is of a much higher class than it previously was. I will now pass to the second point, that of being taught mechanics. Every operation on board a ship is mechanical, and unless a man is a good mechanic, he will not carry out any operation properly. Then we come to gunnery, steam, meteorology, and modern languages. There can be no doubt that they are all required to make an efficient sub-lieutenant. Of course, mechanics, gunnery, and knowledge of steam are essential. Of naval gunnery, very little is known at the present moment, and what is really required is some better stimulus for young Officers. At the present instant, however, it is not known by any one what is the least angle at which a ball will penetrate armour, or what will be the effect of firing at a certain thickness of plate; neither what are the means by which the greatest amount of injury can be done to an enemy. On all these points we require careful investigation and experiment. Then, it is asked in the table, ought general culture, seeing what progress has been made in it of late years in all ranks of society, to be expected of Naval Officers? It is of immense importance that a Naval Officer should be highly educated, and the more highly educated he is, the more valuable he will be to the country. I quite agree with what Captain Goodenough has said in his paper. I think it would be better for boys to remain at public schools till the age of 15. What they acquire at school is, the capacity to learn. Having entered the Navy too young, viz., at 12 years of age, I can truly say, that I learned nothing until I was 19. At public schools, the quickness of action on which so much depends at sea is attained through the rivalry which is engendered between a large number of boys. It is clearly impossible for boys to have a regular course of study when serving in the Mediterranean or Channel squadrons, and therefore it is necessary to place young Officers in training-ships, where they should be under the rule of the best men that you can pick out of the service. The trained youngsters on being passed over to the

sea-going vessel, should be put under selected Officers until reaching the age of 19. I feel satisfied that unless we pay much more attention to instruction than we have hitherto done, we shall fall behind some of the other maritime nations. I must say that so far as I have yet had opportunities of seeing the Officers sent to England by foreign Powers, I have learned more from them than I have from the Officers of my own service.

Vice-Admiral Sir F. NICOLSON: I think the great principle Captain Goodenough proposes is this, that during the period that a young Officer is being, in the general sense of the word, "educated," he is not to be in a common sea-going ship. All who have commanded ships must feel the utter impossibility of giving enough attention to the education of young Officers while the common duties of the ship are being carried on. The whole of a young Officer's time is, as it were, cut up, and I am not in the least surprised to learn that there are only a few hours in each week which can be devoted to special education. I did not quite gather from Captain Goodenough whether he means that the public school education is a *sine quâ non* previous to a young Officer joining the service. I cannot see how that could possibly be carried out, because many young men must join who have never been at public schools. Then, again, I cannot help thinking the actual sea service too short, notwithstanding the time to be passed in the training-ship. Of course there are an immense number of subjects of which a Naval Officer ought to know something, but I think the great object of all naval education should be this, that we should be thoroughly grounded in our younger years. We have all felt, especially some of us who have gone to the College rather late in life, that we have not been so well grounded in elementary knowledge as we ought to have been. It is impossible for any man, however diligent he may be, thoroughly to acquire sound and scientific knowledge in his later years if he has not received a thorough grounding in elementary principles, mathematics especially; nor can he carry out those studies, which I think we ought all to carry out to a much greater extent than we do—I allude to those connected with the physical sciences, unless we have been thoroughly grounded in our early years. It is for that reason that I feel convinced that some such scheme as that of Captain Goodenough's should be adopted by keeping a young man longer under instruction, longer away from the common routine duties, which, as he says, absorbs the time of the younger Officers. As far as that part of the scheme goes, I quite agree with Captain Goodenough. There were two remarks made by my friend, Captain Scott, which I should wish to notice, one was, that up to 19 he learned very little. All I can say is he has made very good use of his time since. But I think that most young fellows learn nearly everything between 14 and 19. I think if any of us can remember when we were between 14 and 19 we shall perhaps be able to recollect the immense progress we made in all kinds of knowledge during that period. Captain Scott has also said, and that is another statement in which I cannot agree with him, that he has learned a great deal from foreign Officers. I confess that that has not been my experience. I have generally found, that foreign Officers have come rather to our ships for instruction, not only in the internal discipline and the internal arrangements of ships, but likewise in seamanship, for which I think we are still, I won't say preeminent, but certainly on a par with our cousins across the Atlantic, and superior in that respect to all other nations.

Vice-Admiral HALSTED: I am happy to have given a stimulant to the discussion. I only want to say a few words. Nobody can more perfectly and cordially agree with and rejoice over the nature and entirety of Captain Goodenough's individual propositions than myself, but I would not commit myself absolutely to them in detail. I think that the course which has been pursued for many years of attempting to cram all knowledge into a boy from 15 to 19 is absolutely a violation of nature. There is not one officer at this moment of real, practical, and sound knowledge, not mere book knowledge, but applied knowledge, within the mark of his profession, who has not learned it by thought, by study, by experience, confirmed over and over again by close practical observation. I went to school when I was 38 years of age, and I declare that in any true sense I never went to school before. There was one single exception, and that was the study of French, which at my school was taught practically by a thorough master. That was the only thing I remember absolutely

of my boy's education. Until I went to the Portsmouth College as a Captain I never learned anything. I am perfectly persuaded that the education of a Naval Officer is one which, if he truly does become, or desires to become, a Naval Officer, must necessarily be ceaseless. Take a man like John Penn, take a man like Joshua Field, or Robert Napier, or any of our great practical mechanicians of the day, they are going on from day to day, they are always at school, always learning. Therefore, to come to the conclusion, that boys at the age of 19 may throw their books away, and fancy themselves perfect for all future positions of life, is wrong. When I was spending some six months at the Paris Exhibition in 1867, perfectly professionally, day after day I was thrown into contact with Officers of almost all ranks, of almost all navies; I was daily more or less humiliated. I do not mean to say there were not many points and many subjects, particularly with regard to practical seamanship, in which I was not perfectly upon my legs, and perfectly able to discuss the questions which were interchanged between us. But with regard to one especial point, the knowledge of a ship, what were the principles, and what the application of those principles in the several details of her construction, even to the extent, or the minutiae, if you like, of the masting, and of applying sail power, or how it was applied mechanically, in all those things I found I was dealing with men who habitually were my masters in investigation. And again here in England I was very gratefully pleased, and I will say surprised, at having had put to me a series of questions very clear, very distinct, very deep, by young Officers in the American training ship "Savannah," who came up and kept me closely employed for four hours, about two or three months ago at the Kensington Museum, over my own work. Now I believe this, that we must teach our young Officers that their education does not cease at the age of 19. I think that no Officer ought to step his foot on board in command of any ship whatever, with the constructional elements of which he is not perfectly acquainted. Such is the course in many services. The moment an Officer hauls down his pennant from one ship, he is made to prepare himself for the command of the ship next advanced in power in his navy, so that when he steps on board that ship he knows what he is going to do. I hope what I have said will be accepted, as it was intended, as supplemental to the valuable and well thought views of Captain Goodenough with respect to the preliminary education of our Naval Officers.

The CHAIRMAN: We have the advantage of having a distinguished Officer of the United States' Naval Service present, Commodore Rodgers. I think he might give us an account of the nature of the preliminary education of Naval Officers in his country. The system is not of great age; it has not been carried on for a very long time in their service, but it has been highly approved of by the superior Officers of the Navy of the United States. If he would kindly give us a slight sketch of the system, we should be obliged to him.

Commodore RODGERS, U.S. Navy: The embarrassment I feel in attempting to speak unexpectedly on an occasion like this, will prevent my doing justice to the inquiry with which you have honoured me. When I entered the American Navy, nearly 40 years ago, the system in force was similar to that now existing in English ships of war. We had in our larger ships a Naval Instructor, usually zealous and anxious to teach, but we were idle and learned little. We had no preliminary training such as that given in the "Britannia." At each of our three larger dock-yards, a Naval Instructor was stationed, and to them Midshipmen might resort to study for a few months before their examination for promotion.

In 1845, Mr. Bancroft, now the U.S. Minister in Germany, himself eminent in literature and science, using his power as the Secretary of the Navy, but without any legislation or appropriation, turned an old fortification with its barracks into a school for the Midshipmen who were to be examined in the coming year. From this small beginning has grown our Naval Academy, increasing year by year, until it has become an admirably-appointed Naval College, the most creditable part of our Naval Establishment.

Our Midshipmen are appointed by the Members of Congress, from residents in their own Congressional districts. They must enter the Navy between the ages of 14 and 18: the average is somewhat over 16. As many of these lads come from

thinly settled regions, where are few advantages for early education, the standard of acquirements for admission has been placed very low. For four years these Cadets pursue a system of close study, during which, often two-thirds drop by the way, only one-third graduating. Every recitation has its value according to its excellence, every study has its multiple; and when the average is made, at the semi-annual examination, many are found deficient, and are turned back or advised to resign. Grave misconduct or continued carelessness involves dismissal. French and Spanish are taught somewhat imperfectly, but sufficiently well to enable a Midshipman on leaving the Naval Academy, to go on by himself successfully in maturing these important branches of a Naval Officer's education. Drawing is well taught. The mathematical course is carefully taught, as are mechanics and natural philosophy. There are short courses of Naval architecture, International law, moral philosophy and chemistry. Infantry and field artillery tactics are carefully studied and recited upon, as is also, to a small extent, the system of field fortification. The battalion drill and light artillery drill in the field run through the four years, and, with one or the other arm, is of almost daily occurrence. Gunnery is carefully and thoroughly taught, theoretically and practically, and the graduates of the Academy are all good gunnery officers. A frigate, perfectly appointed, but without a crew, is moored at the jetty, with its battery pointing on the Chesapeake Bay. This battery is kept in the best sea-going order, and to it the Midshipmen are marched on certain days of the week for great gun drill or for target practice. The allowance of powder and shell is ample. A double-turret monitor is also kept at the school for practice and examination. Naval tactics are taught from text books, and from the use of the blackboard by the instructors. The evolutions are performed by a large squadron of double-banked cutters, of uniform speed, built for the purpose; and this little fleet, manned by the Midshipmen, is manoeuvred by the officers, both under sail and in steam tactics, where the oars serve instead of steam. Seamanship is taught as far as is possible from text books, and from practical instruction in knotting, splicing, and fitting rigging, as well as from the use of good models. A sloop of war, moored at the jetty, is frequently and periodically used for instruction in seamanship, for bending, making, and shortening sail, and sending up and down yards and masts. Steam engineering is taught theoretically and practically, in a house built for that purpose. A steam-engine, built for one of our corvettes, has been put up in a large hall, with its shaft and screw and boilers complete. The Midshipmen are trained to work this engine, with the advantage of broad light and ample space.

It seems to me that the great advantage we derive from our Naval School is, that our Midshipmen while at the plastic age between 15 and 20, have been taught how to study, and have acquired a habit of analysis and investigation that serves them well in after life. Should they have ambition, they may go on with a degree of intelligence, and with a success from which the men of my time have been debarred by the imperfection of our early training. In the ships I have commanded, I have been struck by the quickness and intelligence displayed by the graduates of our Naval School, when a new system of Naval tactics, a new signal book, a new drill, or a new professional system of any kind was presented to them. They have gone at once into its marrow; and instead of thumbing it, have known precisely how to grapple with its difficulties, and to master its principles at once. In my early days it was different. Therefore, while the education at our College is narrow, its great advantage is the habit of severe study and careful investigation that it gives. An incidental advantage that arises there is, the habit of docility it engenders, and not, I think, at any cost of manliness.

The Cadets are always under home influence. Every month a report in each branch of study is sent to the parents, and that report generally brings home pressure in return. If a lad loves his mother, and desires to preserve the reputation of his father's name, that home influence acts wonderfully; it is a great power. The nautical course is good to a certain extent. Every year the Midshipmen make a three months' cruise in a small frigate with half a crew, in which they do a sailor's duty, and are stationed as captains of the top and fore-castle, as boatswains' mates and topmen. The senior class serve as Midshipmen, and at times as officer of the watch. The graduates of our school, who have done so much work aloft themselves,

are less likely to find fault with a man on a top gallant yard, or at a weather earing than I might have done in my day.

The opinions I have expressed are not universally held by my contemporaries in our Navy. Many of them are disappointed in finding these young gentlemen deficient in qualities upon which they justly prided themselves when they were at their age. Unquestionably, when the Midshipmen come to us for service in the fleet, they lack that quick, alert Naval manner that we acquired during our novitiate. They are not so good at first in commanding men, not so efficient in taking charge of a boat or working party. This they soon get, and in every military drill they are masters from the first. Their course has been academic, not purely Naval, but the Naval style of the day may soon be picked up. After all, as has been said here to night, the great object is not so much to make Midshipmen or young Lieutenants, but to make Officers to command the ships of the Navy, and to make the Navy strong and able for the work all Navies must do henceforward. It seems to me that a careful system of training in a Naval College on shore during the years just preceding manhood, furnishes invaluable means to that end.

Captain COLUMB, R.N.: I think the Institution is to be warmly congratulated on Captain Goodenough's paper, more especially as I believe it to be the very first paper on Naval education that has ever been read in this theatre. We have had abundance of papers on military education, but never before one of this description. I might say also that the Navy is to be congratulated on the publication of such a paper in the Journal, for I am afraid that in the Navy the question of education is not considered an interesting subject; I believe that is simply because, as a rule, naval men—from want of education—have not comprehended what education is, in the first place, and what it will bring them, in the second place. Captain Goodenough has been repeating a succession of thoughts which had been passing through my mind, in a less defined form, for the last quarter of a century. The first question that arises is—Is it necessary that we should receive special systematic instruction in seamanship? I don't think there is a greater bugbear put before naval Officers than that word "seamanship." The general idea of what is meant by "seamanship" is how you would rig, and how you would manage a ship of the type of thirty years ago. I think to restrict "seamanship," as it is generally restricted, to the rigging of ships and to the management of their sails, is a perfect mistake. Seamanship for us is the management of our ships, and it now includes the whole of those matters which are placed in the second question before us—Mechanics, Gunnery, Steam. Mechanics, of course, includes hydrostatics and the different physical matters which are connected with ships. Therefore I say naval Officers want systematic instruction in that kind of seamanship. But narrowing the word "seamanship" as far as possible to dealing with the ship as she is actuated by the winds and waves, restricting it to that part of the meaning of the word, we want systematic instruction in the principles upon which depends the management of the ship actuated by the winds and waves. As a rule, that is not the sort of instruction which is given in seamanship. The ordinary instruction that is given to our younger Officers, and the ordinary questions that are put to them in seamanship-examinations are questions referring more to the nature of ships thirty years ago than at the present time. Now, the principles of seamanship are unchangeable; the details change every day. You cannot now get any squadron where the ships will be fitted alike in any one part of their rigging; it becomes, therefore, all the more necessary that you should draw up a systematic course of instruction, in order that the Officers may not take up for principles those things which are details, and spend useless time upon them. Captain Goodenough expresses an opinion that most naval Officers are ill-taught, and I must say that I agree with him. I cannot see a number of English naval Officers brought together with a number of foreign Officers, be they French, or especially be they Russians, without seeing that we are, as a body, very much behind the class of instruction which our compeers in other services have. Captain Goodenough made a remark, and it was followed out by Captain Scott and other speakers, that we are educated to be Lieutenants or Junior Officers, and not educated to be Captains. I suspect there are very few thinking men in the Navy who, when they come to command ships, have not that idea forced

upon their minds, for we have no notion of the sort of work we shall have to do when we are put in command of ships. The kind of education which is given should always have that end in view; and in that view, to my mind, no study is more important than modern languages. As to the early entry of boys into the Navy, I think amongst my contemporaries the idea of entering boys at the early age at which they are now entered has always been held to be fallacious. The difficulty that young Officers have in studying afloat cannot be exaggerated. Their time is broken in upon in every way. For any kind of study which requires close application, there is nothing like the quiet room on shore. I do not quite agree with Captain Goodenough, and it is the only point in which I disagree with him—as to the increasing inefficiency of the Officers of the watches. I understood him to say that, judging from the reports of his brother Captains, it was supposed that the Officers of the watches were becoming rather more inefficient than they used to be. I am unable to say how it may be in the Channel Squadron, but I am inclined to doubt the statement, because looking back through the history of our Navy, I find that that complaint has been uttered for a great succession of years past. In one way we suffer most bitterly from want of education—education of that kind which will enable us to grasp the facts that are before us; we suffer bitterly in the reports, as Captain Goodenough says, which come from the active service to the Admiralty. It is a common complaint of the Admiralty that a large percentage of the reports on the qualities of ships, or on articles under trial, or on any matters connected with material, are worthless. The reason why they are worthless is because the point which would make the report valuable, is left out, because the Officers making the reports have been making them blindly. The result is that the Navy becomes a much more costly service than it ought to be. The Admiralty are totally in the hands of Naval Officers. Whatever may be thought and said to the contrary, it is the opinions of the active service which build our ships for us, and make all those changes which we sometimes complain so much about. The want of education on the part of Naval Officers prevents them from giving the Admiralty the full results of trials, consequently, when Officers have reported that certain things are wanted they get those certain things from the Admiralty, and they find that they are not the things that are wanted at all. Then they complain of what has been done by the Admiralty, while in reality it is their own fault; no, not their own fault, but the fault of the want of original education. Captain Goodenough has remarked that he does not want to make the Navy a scientific service. Of course, in using the words “scientific service,” he used it in its vulgar acceptance. That is to say that science is something abstruse, something that is unconnected with any practical consideration whatever—that a scientific man is a man so embedded in figures that it is utterly impossible to get him out of his figures. But the fact is, the science of to-day is the vulgar knowledge of next year. Science is nothing but a knowledge of facts, and it is that knowledge of facts which Naval Officers want when they cry out for education.

Captain NOLLOTH, R.N. : As the subject of Captain Goodenough's paper is a very important one, as it is rather late, and there are many gentlemen who may wish to speak, I beg to move the adjournment of the Meeting till Monday next, when I hope that the subject will undergo that full discussion which I think it deserves.

Admiral HALSTED : I shall be happy to second the adjournment.

The CHAIRMAN : The meeting will be adjourned with the consent of the Council to Monday next.

EVENING MEETING.

Monday, March 27, 1871.

REAR-ADMIRAL A. P. RYDER, in the Chair.

ADJOURNED DISCUSSION ON CAPTAIN GOODENOUGH'S PAPER.

The CHAIRMAN: This is an adjourned discussion on a paper read by Captain Goodenough "On the Preliminary Education of Naval Officers."

Captain DAWSON, R.N.: The subject of naval education is one in which I have taken very great interest for a number of years, and I have formed some definite opinions upon it. I know no Officer in the Navy who is more entitled to read a paper upon this subject than Captain Goodenough. At the same time, perhaps there are some things in the paper which one may fairly discuss, if not take exception to. I think we must all concur in this, that if the country was in danger to-morrow and Admirals were sought to command our fleets, they would be sought from among half-a-dozen Officers, every one of whom is distinguished in some other line over and above mere professional knowledge, over and above mere seamanship and discipline. Let us suppose a Fleet on the enemy's shore, and the Admiral spies through his glass a telegraph wire. He makes a general signal to the Fleet, "An Officer required to land and tap that wire and find out what the enemy is doing." He should make such a signal with the full assurance that he will find some Officer who will skilfully accomplish such a duty, for I think that in a Fleet there ought to be every possible speciality represented by one Officer or another. That is the general principle which I want to place before you. The general tendency of the recent regulations is to reward most highly the drones or vegetable productions of the service, and that suicidal tendency had better be reversed. Seamanship is an art, once learnt by 15 or 20 years' actual practice at sea, which cannot be lost by 5, 10, or 15 years' service in public offices on shore; whilst the general experience of men and manners, of general culture, and public business, makes an Officer far more capable of commanding men by his superior attainments, and of doing credit to his country either in peace or in war. There are two objects to be kept in view in the education of Naval Officers as to mathematics and science. First of all, there ought to be a compulsory standard fixed, to the minimum of which all should attain. But over and above that, there ought to be inducements held out for voluntary studies, by which Officers should be able to rise in their profession from one rank to another by extra examination in scientific subjects, provided they have also served in responsible positions at sea as first or second in command, and displayed seamenlike abilities in those positions. I do not see why two or three Commanders' commissions and two or three Captains' commissions should not be given away every year to such Officers. I do not want to exaggerate the claims of education. But when I look back upon my own experience, I venture to say that the best commanded ships, those under the best disciplinarians, and the best seamen I have come in contact with, have been those whose Officers have had these extra educational qualifications. At the same time, I have known some excellent seamen and excellent disciplinarians who have not had these extra qualifications, and I say it would be wrong to discourage those men who, not having any scientific attainments, are yet good seamen, good artillerymen, and good disciplinarians. These are the principles upon which I rest. Now, as to instruction in elementary seamanship. It is true that before I was myself 15 years of age I had six months' experience in charge of a watch at sea. Of course, we all agree that such experience was invaluable.

able, but I believe it was an exceptional case. On the very same station the flag ship had more midshipmen than the whole of the rest of the squadron together. She was at sea probably one month in a year, and during that month it is not at all likely that one of those Midshipmen had the opportunity of performing a naval evolution, though they might possibly have witnessed it; but witnessing a naval evolution once a year gives a very small amount of instruction. The experience of most persons will correspond with that of my own younger days, viz., that [there was not a single ship in which I served in which there were not one or two Lieutenants who were not up to their work; not because they were wanting in brains, but because they had not, as Midshipmen, the opportunity of gaining experience, and had received no methodical seamanlike training. In the present day it is far more difficult, not to say impossible, for all the elementary details of seamanship to be taught to Midshipmen in an ordinary sea-going ship of war. Of course there are exceptional vessels; but it is the ordinary routine of the larger ships of war which monopolises the time of the Midshipmen and Sub-Lieutenants. These ships have not the means nor the opportunity of teaching elementary seamanship to young men, because the attention of the Commanding Officer must be taken up with the general evolutions of the Fleet. Besides that, the tendency now-a-days is to do away with masts altogether, and when masts come to be done away with, they will have still less opportunity of learning how to manœuvre and manage ships. I see no difficulty in the world why every detail of seamanship and every part of naval tactics, together with the stationing and managing of men, should not be systematically taught first of all theoretically—and next practically in training ships—every single Midshipman, before he passes his examination, having had the opportunity of putting a ship about and wearing her a certain number of times and conducting certain other leading evolutions. Not only the manœuvring of ships and the management of sails, but the tactics of fleets might be methodically taught in the same way that the elements of gunnery, steam, or light infantry drill, or of any other branch of this or any other profession, is imparted. That cannot be done in sea-going ships, even by appointing a seaman-ship Lieutenant, in the same way that you appoint a gunnery Lieutenant,—the general routine of the ship will not admit of it. Therefore I quite concur with Captain Goodenough in his desire that the young gentlemen should remain in training-ships until they are about 18 years of age,—understanding by training-ships, vessels at sea where this systematic instruction should be methodically conducted. I wish particularly to mark one point in which perhaps I do not quite agree with Captain Goodenough. I think the tendency of the periodical examinations in such training-ships is to elevate mathematics too much and to neglect seamanship. I should like seamanship to be brought up to a level with mathematics in systematic teaching and methodical examination. I can therefore commend that part of Captain Goodenough's paper to the attention of the meeting. I would have this going on up to 18 years of age, and then I think it would be a very good thing if the youngsters did pass a year in a regular ship of war before they became Sub-Lieutenant. Still further, the discipline of our ships would be much improved by having fewer Midshipmen, because more responsibility would be thrown upon the petty Officers, who would thus be brought more up to the standard of trustworthiness attained by non-commissioned Officers in the Army, and you would have fewer punishments and a higher state of discipline. The tendency of the paper would lead one to think that education should cease at 19 years of age. I would therefore repeat that there should be some voluntary examinations opening up the road to every succeeding step of rank, provided Officers showed in practice some qualifications for holding positions of responsibility, by serving either as first or second in command for a certain number of years; and such earlier promotion should not carry with it the pecuniary and other penalties inflicted under the recent Admiralty Regulations.

Captain SHEPARD OSBORN, R.N.: I am afraid I can add but little to the discussion before the meeting, because I have not had the advantage of hearing the paper read. It is only to-night that it came into my hands. I concur to a very great extent, as will be seen by what I said before the late Committee at Somerset House, with Captain

Goodenough. I hold that the educational advantages which the Colleges and other institutions of this country offer to youngsters of the present day, would fully enable them to come up to any standard that the Admiralty in their wisdom, or the necessities of the service required for the entry of the youngsters into the service, and that every father and mother, if it was their ambition to have a boy in the profession, would take very good care that the boy was brought up to that standard. I hold that it is much better for the youngsters to come from all the different sources of education in this country, and to bring with them the varied attainments they would acquire, and that they should retain in after life that individuality of character, which is more likely to be created or exist at 15 than if we take a child of 12 years of age and tried to mould him into some special naval form. I think it is unfair to the Captain of the present day to throw upon him the responsibility of watching over boys of so very young an age. I was particularly struck, in a line-of-battle ship that I commanded ten years ago, by seeing the melancholy results of boys being thrown early in life into temptation, without the Captain being able to protect them from it by the rigid discipline of the past. It would have been much better for those boys to have been at school, within reach of masters, than to have been sent to sea subject to temptations before they are 15 years of age. I conceive that the moral influence of home would be much better for them than the present discipline of a ship, and their *physique* would be very much better. I am convinced that the time will come when we must adopt this principle which Captain Goodenough advocates, of letting the country educate the boys, the father and mother looking after their morals before they are handed over to the profession, and then be put in proper sea-going training-ships, as Captain Goodenough has advocated to-night. But I would go further than that. Beyond that, I would hold out inducements to senior Officers. I would have a Staff Corps—not a mere navigation Staff Corps, such as it is in the present day, when a man is considered a Staff Officer of the Navy because he can work out simple theorems in navigation. I would prefer that if in any department of science he showed any particular ability, he should be put upon the Staff, so that the Admiral of the Fleet should know by the register before him when he wants a particular Officer to do a particular duty, on what particular ship to put his finger for the man to carry that duty out. It would be well for the service if such general principles as those advocated by Captain Goodenough were carried out.

Admiral OMMANNEY: I approve generally of Captain Goodenough's desire to amend the education of the Midshipman, but I do not quite concur with him to the extent of keeping the Midshipman so much under the control of the schoolmaster as he would, up to the age of 18. If I understand the paper, Captain Goodenough would keep the young Officer under instruction till 18, and then he might, if promoted to be a Lieutenant at the age of 19, have the command of a ship, or practically so when Officer of the watch, having had but one year's practical experience as a seaman—he would have to pass at the age of 19 without any practical experience to get the command, or almost the command, of a ship as an Officer of the watch. Now I do not think he would be a trustworthy person. If we look back to our own early days as Midshipmen, when we got to the age of 16 or 17, we liked to get the command of boats; we liked to be on deck to see how things were going on. Having myself had great experience, I think a good Midshipman of 17 or 18 is a very valuable person. We look to him as a good look-out at sea, we look to him as commander of a boat, and we look to get some work out of him. That is the very age at which he begins to learn to fit himself for command. I agree with Captain Goodenough as regards the previous preparation of the Midshipman for the naval service. I think he should not enter before 14 or 15, for the age previous to this is the time, if any parent wishes his son to come into the naval service, to prepare him for it. With regard to languages, especially, I think no person ever acquires any language after entering the Navy. It should be a *sine quâ non* that he should know at least one language when he enters the Navy. I would also say that I think the present standard of examination for a Lieutenant a very good one, and if the youngster could retain all that was grounded into him when he passed for Lieutenant, he would be a very valuable man. What we want to insure is, that after he has gone through his examination he should retain that knowledge, and that can

only be done by keeping him in a responsible situation. As Lieutenant, I served in a ship on an expedition to Baffin's Bay, and crossed the Atlantic in the depth of winter, when there were no Navigating Officers, and I there gained more knowledge of my profession than I should otherwise have done. I would allude to the desirability, as I have always done, of doing away with the navigating class. I certainly have not derived any such great advantage arising from the navigating class as is generally held out. I am quite sure that men would have very much greater confidence for command if they had navigated ships themselves in their early days, instead of having nothing to do with it until they get into a command. I would also like to see a great many more Midshipmen put into the surveying ships at the present day. There is no branch of the service where Midshipmen could gain so much useful knowledge and professional experience as they would if put into surveying ships, *for a time*, much more so than has been our practice. I am only sorry that they have made a retrograde movement in that respect of late, by restricting the surveying service to the navigating class. It is very different from the system which was pursued when Admiral Beaufort was hydrographer to the Admiralty, whose great aim was to employ and improve the executive branches. I can only repeat that I quite agree with very much that Captain Goodenough has suggested.

Commander H. W. BRENT, R.N.: I am glad to see that those who have taken part in the discussion agree so much with Captain Goodenough. I congratulate the service generally that, through the instrumentality of the "Journal," they will have so much to talk about and think over, I also wish to add my testimony to what has been said in the lecture of the zeal and hard work of the Naval Instructor. I do not know any class of Officers on board our ships that I pity more. They have to work with everything against them, as it has been stated, although undertaking to teach the boys that are under their charge, they must feel that their time is almost thrown away. Seven or ten hours a week, as anybody who has taught boys must know, is not sufficient. Besides the Naval Instructor, who gets the boys two days a week, there is the Gunnery Lieutenant, trying to load them with gunnery, but he cannot do it; he gets them perhaps for two afternoons in the week. One afternoon is taken up with steam, and instruction in seamanship is left out entirely; it is left to be taken in by induction. Perhaps Monday is given to it, if there is no boat work, perhaps Saturday, and after all seamanship, which has grown in vastness and magnitude in the present day beyond all other branches of the naval profession, has no regular teaching or training; the whole thing is a complete failure. We want a great deal of education; the want of education is most painfully felt. This is the first time I have noticed a difference made between education and training—that education should come first, and professional training afterwards; it is a very important distinction to notice. With regard to the boys from the "Britannia," I know that the public school boys used to have a kind of contempt for internal arrangements, because there were no upper form boys for them to look up to. Beyond that I know nothing, but am sure the boys from the "Britannia" are decidedly better than the boys that came into the service 20 years ago. Finding those Officers I had met who came from public schools were better than others, I arrived at a conclusion that the foundation for a naval Officer must be a general education; that the examination must be a general examination, comprising all the subjects that are taught at our public schools. I am convinced if we could get all our youth for the service from the public schools, it would be a great advantage, but seeing that that is impossible, it strikes me that we might get out of the difficulty by having a naval college established on the same principle as our public schools, taking the sons of gentlemen from nine years old and upwards, those for the service coming in at eleven, and staying till they are 16, wearing no uniform, but being exactly on the same footing as at Harrow, Rugby, and Eton; then at 16 to pass a general examination and to become cadets; from that period, the summer to be spent in training-ships, and the winter on shore and in college. At 18 I would have them go on board some sea-going ship to go away to sea for a year; then at 19 to come into the service and serve as sub-Lieutenants. We do not want Midshipmen now-a-days, the petty Officers can do their work. I think the time has come when,

much as we admire the Naval Instructor, if we have some such system as I have described, we shall want no Naval Instructor afloat. The boys coming out at 19, and having been well grounded in education—educated so as to feel their ignorance—for it takes an educated man to know he is ignorant, I think with some little assistance they could go on with their studies without the Naval Instructor. I would include modern languages, which I think is the greatest assistance to naval Officers. Naval Officers of all others should not be debarred from a general education. I take it that the subjects which come before a naval Officer are almost unlimited, and for that reason I say their education should be general. One thing more I wish to say. There has been a remark in the paper about the watch keepers. I do not think the watch keepers are so very bad as they have been represented. I have a strong recollection of watch keepers in sailing fleets 20 years ago, and if their Captains did not think them efficient, it was no common thing to find Lieutenants keeping watch on the fore-castle regardless of seniority. There is a great deal more expected of Lieutenants now than there used to be; but I think the article is improved. What the requirements of the education are, I must leave to other people to decide who know what is to be expected from lads of various ages, and also what the training should be. Of this, however, I am quite sure, that education is of vital importance. Our naval Officers must be educated in all the subjects that come before them, not only scientific, but those that relate to the changes in our material, having under them educated and trained seamen whom they must command by their knowledge of their profession in its entirety, which constitutes power, there would then be less trouble on board the ships, discipline would be better kept up, and our Officers would be in a position to deal with any subject that came before them.

The Rev. Mr. MIDDLEMIST, of Harrow: In the presence of so many practical men who know much more about the Navy, and about the training required for the Navy than I can possibly profess to do, I feel a great deal of diffidence in expressing my opinion upon this important question of the education of naval men. Still, having had many years' experience in the training of boys for the Navy (I will not give up that word to the gentleman who has just spoken, because training goes on at school as well as in the Navy), as well as in the training of boys in public schools for public life in general, I venture to offer a few suggestions to those who are now present. Having had so much connection with the Navy, and having such a respect for the worth of naval Officers and for the use and ornament they are to their own country, I should be exceedingly distressed to find that that should be the only service in the world that should stand still, and should not follow the advancement in the culture of mind that we see increasing all around us. I will just make one or two remarks with respect to the training of boys for the Navy, or for any other profession. So far as the Navy is concerned, I do not think it is of the slightest importance, up to a certain age; whether the boy be on board ship or whether he be at a public school, provided he has good training. I do not think either, from my long experience of boys, that it is of the slightest importance what it is you train him in, provided, of course, it is a good subject. I believe even that the further it is from his destined profession the better it is for him, because if you only train his mind to take up any subject whatever in order and methodically, and to study that thoroughly whenever his mind is put to it, I think he has gained his object, especially with respect to a boy who is destined for the Navy. When he goes on board ship he is then cut off from all possible circumstances that can tell upon his character, excepting those that are immediately near him; and I am sorry to say, from my knowledge of the subject, that those circumstances are often not of a favourable kind, and I think the longer that he is kept under other discipline and with other training the better. I am quite sure that you will turn out much better naval Officers by leaving your raw material under the schoolmaster, as the worthy Admiral mentioned some little time ago, a little longer than you have hitherto done. Now I think, with regard to the Navy, that it is a most important point that you cannot lose sight of, the moral training of a boy's character. You cannot possibly get a boy's character established until he is 16 or 17; it is utterly impossible. Therefore I feel quite convinced that Captain Goodenough, who has come forward in the most noble manner to advocate a longer training on land for the youths that are

hereafter to be our defenders against whatever enemies may assail us, has rendered good service to his profession, and I think everyone who can appreciate good education will be thankful to him for raising this question among us.

Commander ARTHUR H. GILMORE: I have not had the advantage of hearing Capt. Goodenough's lecture, but I am sure it is a subject in which all Naval Officers must take a deep interest. I think still from what I have heard to-night, that we are inclined in the present day to take too much tithes of the mint and cummin in the matter of cramming science into the boys, and neglecting the greater matter of seamanship. The gentleman who sat down just now has gone rather too far, I think, in saying that boys should be kept away from the influence of the profession, and to what I consider too great an age. Teaching a lad things unconnected with his future profession cannot, in my opinion, conduce to his advancement in that profession. I cannot see the advantage of keeping a boy away from the Navy if he is to become a sailor. We must all agree, that the more scientific an Officer is, the better Officer he is. Still, a sailor ought to be a sailor. You cannot manœuvre a fleet by algebra. A sailor to be a sailor must be a man with intuitive knowledge, with a love of his profession, able to grasp a thing immediately. Mathematical men are not people of intuitive knowledge; they are rather a people of calculation. Captain Dawson said that an Officer of a ship ought to be fit for anything; that if a wire required tapping the Admiral ought to be able to send a signal and find an Officer to tap the wire. But the Admiral must know or appreciate the necessity of getting that information; and must manœuvre his ships so as to protect the landing, and at the same time to keep them clear of the shore, so that even here a little seamanship is required. I quite agree with what Admiral Ommaney says, that some Officers should be appointed to surveying ships. I had the pleasure to serve in one, in which there were ten midshipmen besides myself, and I am sure we all derived a benefit from what we learnt in that surveying ship. Now, we who belong to this Institution have the benefit of reading the Journal. The Admiralty does a great deal, at least does something for the Institution; why should not the ships be supplied with the Journal of this Institution? I think it would be for the benefit of the service generally. Captain Brent spoke very truly of the difficulty that naval instructors have in getting youngsters under their tuition. Having been a Gunnery Officer, I know of my own knowledge the difficulty of getting the midshipmen together for drill, and so can sympathise with the Naval Instructors. I think that might be avoided by having the youngsters in watch and watch—that is to say, by dividing them into two parts, one-half the time to be given to watching—keeping boat duty, &c., the other half to study. I think when youngsters enter the service at 14, they should go into the "Britannia" for a year, or a year and a half, then, instead of going in a lump into a training-ship, they should be dispersed in a flying squadron; there they would learn seamanship, and would also have the benefit of Naval Instructors' services; at the end of their two or three years in the squadron, they should go for a year to College, and then pass their examination for Lieutenant. They would have had the early instruction on board the "Britannia." They would have the experience on board the flying squadron. They would have a theoretical and mathematical education in the College, and they would then become matured, and fitted to take their places in command of the deck. I think if boys go to sea at 16 or 17, they go when their impressions are unsusceptible; they go like amateur yachtsmen; they fear nothing because they know nothing. They know a great deal about mathematics, but they know very little about seamanship. The education of a man does not commence at school or at College. Education goes on day after day, year after year. Of late years much has been said against "talking shop." Now "talking shop" is talking about a thing that most interests us. And I am sure a sailor cannot have a subject more interesting to him than a ship and the service. With regard to the distinction between education and training, I think the word discipline would embrace both these terms, and be preferable. Discipline, we are told, is the art of understanding, and knowing those things which are more immediately connected with the duties of our profession.

Captain BEAMISH: I had not the pleasure of hearing Captain Goodenough's lecture, nor have I had the opportunity of reading it, so I speak without my book.

Though I do not profess to know a great deal about this subject of naval education, still it has occupied my attention for a long time. I have jotted down certain things about it, and certain matters have come under my notice, particularly during the last year, while employed in command of a ship in the Channel Fleet. I had not, until February, 1870, been for some little time on full pay, and I found a great difference in the youngsters in the Fleet—what they are now as compared to what they were even six years ago. There are several points in which they are different, and one thing in which they are especially deficient is in the matter of seamanship. I belong to a ship which has five masts, and it is positive folly to expect lads to learn to wear or tack her at sea. Such a ship is not one in which to learn seamanship. It is true that the Naval Instructors in the Channel Fleet have a harder time of it than former Naval Instructors, because Sir Thomas Symonds most properly insisted on steady schooling. Positively the only way in which boys in these huge ships can learn seamanship is by being taught in classes on certain days, for as to learning seamanship on deck in the ordinary evolutions of a ship, that is out of the question. They are taught seamanship two days in the week, and that is all the instruction they get. I find with these exceptions and a little gunnery, there really is no tuition. Geography and history are nowhere. I cannot help thinking that those boys ought to have been taught better before they came into the service. I am not in favour of boys being very old before they come to sea, but I say if they could be given a general training in history, geography, mathematics, and certainly a good training in foreign languages, before they come to sea to be taught seamanship by going in cruising ships, those boys might be well turned out of hand at 16, and sent into the Navy before they are too old and too proud to learn to do their work. I am not sure that boys are any the better for coming to sea at 11 or 12. I have had something to do with passing youngsters. They come up, these poor lads, and after they are plucked, I have often asked the question where they had learned their seamanship, and I find that they have been in large ships, where they have had no chance of learning it. They ought to have been put into a "Bristol," a "Trafalgar," or some sort of training-ship. They have never had to take charge of a watch in their lives, and then at 19 they come up to pass. I would have Officers encouraged, much more than they have been encouraged, in our service, to learn languages. We have got an idea that there are interpreters in the service, I have never seen one in my life. When I wanted to get a young fellow out of the ship (and this is connected with education, because the Captain will take a little interest in their education if he knows something about them) I could not do so. The very first thing you find if you want to get a youngster to a sea-going ship (for the poor boys want to go) that you cannot do it, and perhaps three months afterwards you see in the columns of the "Standard" (which seems to be the only paper in which these notices appear) that Midshipman so-and-so is appointed to such-and-such a ship. Now if these boys came to you in the same position as other Officers in the ship this would not matter. As long as these boys are under you you have to look after their education, and so take an interest in them. It is extraordinary how the parents will write and ask you to take a boy into a ship, and look after his interests and teaching, and yet when you least expect it you find his name in a newspaper going into another ship. My experience during the last five years has been that our petty Officers are perfectly well able to take charge of our boats, and a dozen other matters of duty. Let the youngsters be educated before they come on board; I am not in favour of doing away with a Naval Instructor. There is one subject upon which Admiral Ommanney spoke. It has to do with the hydrographic department and the surveying ships. The other day when I was asked for a remark or two on the subject of education, I sent in a paper to the Committee, in which I touched upon the necessity of having Officers on board as Navigating Officers, instead of the present navigating class. I am highly in favour of that. With all due respect to the gallant Commodore on my right (Commodore Rodgers, United States' Navy), I am not quite sure that I take up the idea that American Officers hold, because I think the system is always changing. You might very easily have Navigating Officers in our service who are really the ordinary Lieutenants, but they must be allowed to stick to it for a very long time. I think we gain greatly in our service by having an experienced

Navigating Officer, and I should not like to have the junior Lieutenant as Navigating Officer. It is really an extraordinary thing, but if you look at the hydrographic establishment of the British Navy there are only two Captains and two Commanders training for the hydrographer's place. The Admiralty makes a point of not putting anybody from the staff corps into the position of hydrographer, and depend upon it if the gallant Officer now at the head of the hydrographer's department were to retire, or to die, the Admiralty would not put into his place an Officer belonging to the staff corps.

Mr. SPENCER BUTLER: Having had the honour of serving on a Committee of Naval Education, the report of which my friend Captain Goodenough has rather severely criticised, and having even had the honour of examining you, Sir, upon that Committee, I should like to say a few words with regard to the relation which that Committee bore to the preliminary education of Officers. It was no part of the instruction, and therefore no part of the duty of that Committee, to examine the question which has been raised by Captain Goodenough, as to the preliminary education of the Navy. Everybody who knows what an Admiralty Committee is, knows that they have certain instructions beyond which they can hardly travel. It had been decided very shortly before the meeting of our Committee on "The Higher Education of Naval Officers," that a certain course of study should be followed until further orders on board the "Britannia," of which the principal feature was that the education was to begin a year earlier than it had previously done. The Committee, of which I was a humble member, had to accept that as settled by authority, and all that we felt competent to do was to take up the question at the point at which it had been just left. The evidence before us established that the preliminary education as it stood was deficient; it seemed to be undoubted, and nobody to-night, as far as I gather, denies that the system of instruction on board the ships of the Fleet, is almost a nullity; and, assuming this, our Committee thought that, as a palliative and remedy for the existing shortcomings, an additional year added to the "Britannia's" instruction would be so much clear gain, and would at any rate mitigate an evil which was established by all the evidence to exist. But if it had been put before us, to investigate the larger question raised by Captain Goodenough—whether education in a special State College, between the ages of 12 and 14, is better or worse than education in the general schools of the country during those tender years—without saying what the Committee, as a Committee would have held, certainly I, for one, quite irrespective of the question raised to-night, whether a school for small boys is best afloat or on shore, should have been very much in favour of the proposition which Captain Goodenough has brought before us, because I am certain that young boys like that are much better if they receive a general education, an education which does not exclude mathematics, but which includes many other things, and which is also conducted by a class of men who give themselves to the science of education, and the picked men of which are to be found in the public schools of the country. The science of education is just as much a matter of study and a matter of training as the science of commanding ships in the Navy. I happen to be very much connected by relationship with some of the heads of our great public schools, and I believe I may assert the fact that it is very much easier—probably because the field for the selection is larger—to select competent and accomplished teachers in the classics than in mathematics. In this country the greater part of our general education has hitherto been classical, and the mathematical schools have been the exception. And I believe it is felt to be a comparative difficulty, even with the salaries which the public schools are able to offer, and which are very much larger than are given to Naval Instructors employed by the Admiralty, to select mathematicians equally well adapted for the general education of boys. Believing this, and attaching the highest value to a good general education, I would wish to disclaim on my own part, if not on the part of the Committee who sat on the higher education of the Navy, any opposition to the general views which Captain Goodenough has so ably propounded. There is only one other point which I might be allowed to state, though not strictly germane to the proposition before us to-night, and that is, that the scheme which the Committee did recommend—however much opinions about it may differ—for a larger staff college than now exists, had these peculiar

characteristics which I think Naval Officers will appreciate, that it did not propose to lay down, as is done in the elaborate courses of the American, Russian, and French Naval colleges, any one general scheme of education which every Officer in the Navy must pass through. We had before us the placing of the different students on leaving the American college in one year, as shown by the final examination in the several branches of study, and I remember being struck by this, that those who came out highest in the examination were, as a rule, those who took in the greatest number of subjects and got the greatest aggregate number of marks. Thus the most distinguished Officer of the year, so far as the college diploma went, was not the man who was best in seamanship or best in those practical branches of study which are specially calculated for service afloat, but the man who had the greatest amount of general knowledge. If I remember right, the Officer who was first in seamanship and first in gunnery, stood only fifteenth in the whole examination. This appeared to us to be a defect in a professional college. It seemed to us far better to follow and develop the system which has heretofore, so far as it has gone, prevailed in this country; and that in reorganising a college for the higher education of Naval Officers, you should indeed, as the gentlemen on my left ably stated, encourage every variety of knowledge which the individual bent of a Naval Officer may point out to him, but give separate certificates of proficiency in each particular branch of study, regardless whether in any other branches of study the same Officer was proficient or not. I believe that this part at any rate of the labours of the Committee will commend itself to the profession, and will sooner or later be followed, and I only wish we had had in evidence before the Committee those views both on the preliminary and higher education which Captain Goodenough has so ably put before us here.

Captain FIELD: I should like to make a few remarks, though I regret I have not been able to read the paper under discussion. I have gathered from my friends around me some few points in it, and I am very much pleased indeed to find that Captain Goodenough has brought this important question before us. One or two observations have fallen from previous speakers to which I take strong exception. One remark fell from a gentleman connected with Harrow School; he seemed, in my opinion, to lay too much stress upon training in public schools. I hope gentlemen will not think that I am an opponent of public school training, because I go with it up to a certain point. I think it is very valuable to many, because it tends to develop manly qualities in a boy; but I do feel very strongly that public school instruction, if carried out according to the present practice, instead of being beneficial to a lad about to enter the Navy, would in reality be a great waste of time. Train your lads in public schools, if you like, but do not waste their time; do not teach them things which possibly may not be of any service to them hereafter. When parents desire their sons to enter the naval service, let them ask the masters of public schools to shape their instruction accordingly. Surely mathematics will expand a boy's mind far better than Greek. I am told that Captain Goodenough has alluded to the navigating class in his paper, and that he himself is rather in favour of not having any special class at present to carry out the navigating duties. In that I heartily go with him. Let it be considered a special duty by all means, and the moment an Officer takes up that special duty he will perform it more satisfactorily than other Officers who have not studied it to the same extent, just as a gunnery lieutenant can perform that duty infinitely better than any other Officer who has not learned it. There was a remark made by the last speaker on the subject of the Report of the Committee on Higher Education of Officers. I read that Report with much interest, and it was a source of great regret to me that the Committee did not feel themselves able to enter into the question of the preliminary education of young Officers, and the age at which they should enter; if they could have gone into that question, I think possibly some good would have resulted from their enquiries. Children of 13 are much better at school having proper moral principles instilled into their minds, and then, if they are sent to sea in a training-ship at 16, there is some hope of the lads turning out well and becoming a credit to the Service.

Mr. ALFRED EAMES, Secretary of the Royal Naval School, New Cross: At this period of the evening I shall occupy your attention but a very short time. Having

been honoured with an invitation to join in the discussion, and having been connected with the Royal Naval School since its foundation, nearly 40 years ago, I take the opportunity of making a few remarks upon two points which have been brought under your notice. I shall not presume to enter for a moment into the professional part of this question, but it seems to me that the experience I have had at the Royal Naval School will enable me to speak with some certainty upon two subjects; first, the early age at which boys leave the school to enter the Royal Navy; and secondly, as to the advantages which accrue to all alike of the young in having been educated at a school bearing a public character. It appears to me that there is so much concurrence of testimony with regard to the early age at which boys are now obliged to leave school, that it would be hardly necessary for me to enlarge upon that branch of the subject; but it does seem preposterous to suppose that a child sent to school at 10 years of age, and in three years,—at the age of 13, when he is more fit for the nursery,—should be expected to enter the service of his country. It also occurs to me that the Royal Marine corps may be compared with the Navy in that particular. I hold in my hand a few statistics about what the Royal Naval School has done during the last 20 years with regard to the Navy and Marines. I have referred to my books, and I find that during the last 20 years more than 300 boys have passed through the Royal Naval School, and have become naval Officers. My respected friend, the Principal of the Royal Naval School, who sits near me, could address you with much better effect than I can, but whose recent connection with the School indisposes him to speak authoritatively on this subject, concurs with me in thinking that the earliest age at which boys should leave school is 15. With respect to the Royal Marine corps where boys are allowed to enter between the ages of 17 and 19, this is the result:—During the last 20 years 80 New Cross Boys have entered the Marines. One-third of that number have gained the artillery, and 11 passed first in their examination for the Royal Marines. The actual number of former pupils now on the active list of that corps is 82, 27 of whom are in the Royal Marine Artillery; on the reserve or retired list 23, of whom 8 (or one-third) are in the artillery. These are good reasons why if the age for entering the Royal Navy were extended, much better results might be attained than at present by a child leaving school at the age of 13.

Captain SHERARD OSBORN: You say 300 entered the Navy. Have you any statistics of those who have risen?

Mr. EAMES: Many of them are most distinguished Officers in the Navy. I was going through the Navy List to-day, and I was proud to observe how many were educated at the Institution with which I am connected, some of whom are now members of the Council. I thought I would not let this question pass after what had been said about the great public schools, without saying one word about the Royal Naval School, which has done so much for the Service.

Mr. ESCOTT: Perhaps as you have travelled to New Cross, you will allow me to take you to Greenwich. The system of education at Greenwich has always been to teach youths from the age of 10 to the age of 15. At the age of 15 in former years many gentlemen entered the Navy, and have taken high position in the navigating class. I have heard from gentlemen of the Navy that the boys who have left Greenwich School are some of the finest lads in the Service. The amount of education they receive up to that age, especially in mathematics, has been marked, and the School has always been spoken of very highly by gentlemen of the Navy; therefore when I saw a paragraph at the end of Captain Goodenough's paper, I was very much astonished, and felt myself bound to come and say something on the subject. The paragraph to which I refer is an extract from a paper read here twelve months ago by Mr. Edwin Chadwick. It is as follows:—"I ought not to trespass upon your time by quoting from his (Mr. Chadwick's) paper, but a fresh perusal of his remarks on the result of inferior teaching given at Greenwich School is instructive, for the results of bad teaching are as harmful to young gentlemen as to young Greenwich boys." There are a large number of navigating Lieutenants, and, I think, 9 Naval Instructors in the Navy who have left the Greenwich School, and I am sure it must pain every one of these, as well as other Greenwich boys, to see such an assertion going before the world uncontradicted. There were some gentlemen of

my profession present at the reading of that paper; among them the Rev. Dr. Hill, who sent me these words: "We should at once have replied to any change of inferior teaching in the sense of the school instruction delivered in the class-rooms, 'but nothing of the kind was adverted to.'" I thought it my duty then to refer to the paper itself, and there I find that Captain Goodenough has quoted the paragraph correctly. It is this: "At one time the education was of a very inferior character 'given by inferior teaching power.'" So far this is quite correct. But it goes on to say on the other hand, "The education and the quality of the teaching power was 'improved and its amount augmented, and boys were produced of a general good character. I have not seen the recent returns. Those I obtained were for 1862, 'when the 'ship characters' were of 150 boys: 'very good,' 88; of 'good,' 40; of 'fair, promising,' 9; 'indifferent, lazy, and troublesome,' 2.'" Some independent opinions that I have gathered from Parliamentary Blue Books I will refer to if you will allow me. Admiral Richards says: "The entry of Greenwich boys into the Navy is desirable, not so much from their numbers as from the very *high character* 'which they bear, and the *very high character* of the school.'" Other opinions equally flattering might be added, but I will not take up the time of the meeting, but simply thank you for your kindness in allowing me to make this statement.

Captain TOYNBEE: I have much diffidence in saying anything upon this subject, but can give a kind of negative evidence as to the good quality of Captain Goodenough's paper, for when in command of an East India passenger ship, I generally had a dozen young gentlemen, and my custom was to give them an hour or an hour and a-half's training each day. I was surprised to find how boys who came in with a good school education at the age of 15 or 16 went ahead of the little boys who had been longer at sea, which I attribute to the superior advantage of longer training on shore. I have had youngsters who had tried for the Royal Navy, and failed, but eventually turned out very clever seamen and navigators. I well remember one instance in which a boy who had failed to get into the Royal Navy, led the way aloft in a cyclone to help in securing the mizen topsail, and I could not but think that such a boy must have done honour to any service. I have heard remarks made on the probability that some Naval Officer might copy his day's work. I wish some could be persuaded not to copy the barometer. It is too common with sailors to think that the barometer is of no use in fine weather, whereas it is really of great use, and it would be well to impress on all Officers that whatever they do should be done well. It is not because the Officer who is appointed to record the barometer cannot do it properly, but he does not see its value, and needs the fact to be impressed upon him. The science of meteorology suffers much from the fact that *all* observations have not been carefully taken and recorded, in *fine* weather as well as in foul.

Admiral AYLMER PAYNTER: The only observation I wish to make on the very early age of entry into the Royal Navy is, that I am one of those unfortunate Officers who entered the service at twelve years and a half old. Now at the age of 15 I could tack a ship with three masts, but my friend Captain Beamish declares he cannot tack or wear his ship with five, and I actually took the "Agincourt," the ship he now commands, in and out of three ports without any masts at all, and therefore you ought to allow me as a poor fellow who joined the service at twelve and a-half years old to know a little about how ships were handled in times gone by. I believe myself that we nailed victory to our mast by early training in seamanship. It is not because a lad enters the service at 13 that he is not a good seaman in the present day. It is because he has not the constant opportunities we had formerly. There was not a steamer afloat in our service. I defy any class of lads to be educated on board a ship-of-war now which can combine all the necessary educational qualifications. You cannot have it on board ship, but it can be given to a boy of 15. You can force by degrees on the boy's mind if he is at a nautical school the necessary accompaniments which will attend him on board ship; you can give him the rudiments of chemistry, the rudiments of gunnery, the rudiments of seamanship and navigation, and the rudiments of steam. When he has been on board a training ship for two years, I should only be too glad to have an Officer under Captain Goodenough's programme, provided he had been 15 years at a public school. I won't say overweight him with Latin and

Greek, but certainly let him be taught French and German. A gentleman beside me, who is a good linguist, has declared to me that in the course of his life he has never met a body of Officers so little educated in the languages of Europe as our Naval Officers, but upon all other points he says he has never found their equal. Therefore, I agree with Captain Goodenough, and hope the Board of Admiralty will see the absolute necessity of putting youngsters into our Navy at the age of 15, because in steamships you cannot teach them practical seamanship, and you have got to teach them seamanship, chemistry, mathematics, gunnery, and navigation.

Captain TOYNBEE: May I say another word—I forgot an important point. Commodore Rogers, of the United States' Navy, spoke of home influence. It was always a point with me to tell a boy when he came on board (and to tell his parents also) that at the end of the voyage I should give him a letter which would serve him well in future life if he behaved well, but that he would be obliged to let his parents see it, whether it contained a good or bad character. The value of home influence cannot be exaggerated.

Admiral of the Fleet, Sir GEORGE SARTORIUS: The lecturer has spoken much on the subject of early education. It is true that the difference of circumstances between the sailing ships of the Navy in olden times and the present may make some little alteration in the system of education necessary to adapt it to the wants of the day. We must remember, however, that the former system of sending boys to sea at 13 or 14 could not have been so bad as some are inclined to think. Remember our Nelsons, our Howes, our St. Vincents, in fact, all the first-rate naval heroes of every time came very early to sea, and they had not a scientific education—they were not known for their scientific abilities. We must remember also that our profession is essentially a practical profession. Skilfulness acquired by practice is of more use than scientific knowledge alone. The scientific man may know how things ought to be done, but until he has had a great deal of practice he can never have that presence of mind—that readiness at expedients, which would extricate him from sudden unexpected difficulties. The two qualifications ought certainly to be combined; this is the great object to aim at. Captain Goodenough has made a very good observation upon the point, that you cannot make the "Officer" stoop to be the school boy. Have the school boy first, and let him get a practical knowledge of his profession in all these little ways, which if he had been three or four's older he would not have stooped to acquire. The introduction of steam has certainly very much altered the system of education, which is necessary now, but was not so necessary in my younger days, when we lived altogether on board, and were always at sea. In the course of a four months' cruise we perhaps got eight or ten days in harbour. Our knowledge was acquired on the sea—by constant experience and constant practice on the sea. It is very different now; it is very rare, comparatively, that our large ships go to sea, and it is more rare still that you can get any practice in seamanship. Still, whether you have masts, yards, and sails, or whether you have only steam, constant practice and experience under all the possible varying circumstances that you will have to encounter in ships at sea, particularly on active war service, is most essential, and most important; therefore you should have as much of it as you possibly can. An observation was made by a gentleman, that it is necessary to find out what are the peculiar qualifications of Officers. Every individual has a character and peculiar qualities which more or less distinguish him from others, and it is very important and very useful that the Admiral or Admiralty should have some means of ascertaining before hand what are the peculiar abilities of the Officers that are serving in our fleets. To obtain this end, Officers should be subjected to a system of examinations, up to the Commander's rank, the most useful and varied subjects to be put down, and out of those subjects the individual to be examined should be permitted to choose three or four. The nature of the selection and the degree of ability exhibited in the examination would soon show the characteristics and calibre of the man. This would place upon record names from which to select the fittest persons, for the nature of the service required to be carried out. There is very little in the paper upon which I cannot agree, but only on one or two points in which I may differ at present from Captain Goodenough, but with regard to the general

tenor of the paper I give him the greatest credit for the able manner in which he has explained his views.

The Rev. M. SLATER, Principal of the Royal Naval School, New Cross, said that with some experience in the education of young boys, he was entirely of opinion with those gentlemen who had argued that a lad could not possibly be supposed to have reaped much benefit from an education which must end at the age of thirteen; that the subjects which they are expected to get up are too many and too difficult for them.

Captain GOODENOUGH: I think it is very evident that the whole of this discussion has centred round the question of early entry or not early entry. That was the remark which I set out with in my paper. I think I said it was very evident that not only the Committee on Higher Education, but that almost all those who were examined before them had that question of elementary education and of early entry standing in their way during the whole time they were trying to consider the higher education, or what I may call the staff education of naval Officers. That being the case, I dare say you will allow me first to refer to some gentlemen who are absent, but who have been kind enough to write to me on this point, because I think that though I may not have actually *misrepresented* what they said and what they thought, I may possibly have had recourse to the old artifice of over stating what I fancied was my opponent's view, in order that my victory over him might be more complete. I certainly did wish to take all the parts of the Report on Higher Education which I fancied stood most in my way, and which most opposed the scheme that I wished to bring forward, in order that I might place them in the clearest light, and then try to overthrow them, and to show that the positions which they took could not be maintained. Therefore I should like to refer to that first. I am exceedingly obliged to Mr. Spencer Butler for the information which he has given us, not only as to his own share on the Committee, but as to the instructions which the Committee had, because that will materially alter the way in which I confess I viewed the Report, and I have no doubt that it will also materially alter the way in which other Officers who have not read the evidence, and know the Report only by its words, will also look upon it.*

In referring to the remarks which have been made in this theatre on my paper, I may be allowed to refer first to those which we had the pleasure of hearing from Commodore Rodgers, a distinguished Officer of the American Navy. We were particularly fortunate in drawing him out the other night, for I think it is the first time we have been able to do so in this theatre. He has so clearly identified himself with our service since he has been in England, that we hail anything he says with peculiar pleasure and peculiar sympathy. I was very glad to hear him speak of the American school. Indeed it was when visiting the school then at Newport, Rhode Island, in 1863, that the rambling thoughts which I had on the subject of naval education first began to gain definite shape, and it was what I saw there which first induced me to address the Admiralty on the subject of naval education. I had gone over to America to report on the guns and ships, and *matériel* of war, generally; but I was so struck with the Naval College, which I was not told to visit, and which I quite dragged into my Report, that in reporting to the Admiralty on my return, I said, "In my opinion the Naval College which I now beg to report on is the most important feature of the American Navy." It quite surpassed, in my eyes, everything that I saw of ships and guns, which were merely transitory, because I saw in the College established at Rhode Island then, now at Annapolis, a seed for the growth of a future Navy, which far surpassed in interest anything which was then going on in America, interesting as all their operations of war were. I was more particularly struck by the fact that no war panic, that none of those terrible scenes which were then enacting in America, that no demand for Officers and men was able to disturb that great establishment; and I think if we require any other

* The speaker then read letters from Professor Main, and Messrs. Laughton and Tompkins, approving of the views set forth in the lecture, and arguing against early entry.

proof, that was as strong a one as we can have of the immense constancy, persistency, and assurance of success then exhibited by the American people and the American Government, the maintaining of that College under such circumstances, without the diminution of an instructor or of a dollar, was a remarkable historical fact. Commodore Rodgers made one remark which I should like particularly to refer to. He rather said that there was a complaint in the American Navy that when young Officers came on board they were not so good at commanding men as their predecessors; and he was quite ready to accept that defect in consideration of all the other advantages which the young Officer possessed when they came on board. But I think it is possible rather to improve on the plans which are in force in America, so far as to make the last year of our scheme of training rather resemble that in the "Jean Bart" in the French Navy, where there is a method of instructing Officers how to command men. The Officers in the "Jean Bart" in the last year of training are put under very experienced and excellent Lieutenants in command of the watch, in command of the forecabin, in command of different parts of the ship, and under the guidance of the Lieutenant of the watch they are made to give orders themselves. The "Jean Bart" has always a picked crew, so that there are not many mistakes made. In short, the men are well trained, so that they answer to the word of command better than an untrained ship's company. There were some other remarks made by an American Officer which were put into my hand, and which were so interesting that I daresay I may read them to the meeting. A gentleman, a friend of mine, was in Washington at the time when the "Monarch" was at Annapolis, and during his stay there he was going about sight-seeing in Washington, and he says in a letter which he wrote to me the other day, "In the course of sight-seeing in Washington I got into conversation with Admiral Goldsborough and a Commodore whose name I forget, both of whom thought I was some American friend of Captain Simpson, and they discussed the 'Monarch' before me, and in general terms I joined in doing so. The Admiral then said that the thing which had struck him very painfully was the want of intelligent appreciation of the various fittings in the 'Monarch' shown by the young Officers to whom he had talked, and his conviction that it arose from such ignorance of theoretical principles as precluded them from feeling curious as to the practical application of them, and he added that he was sure that if the 'Monarch' was an American ship their youngsters could not have been so easily puzzled as to 'the why,' as he found three or four of ours were. My friend here interposed and drew me off, and then told Admiral Goldsborough who I was, upon which he apologised to me for having said it before me, though he added that he greatly regretted not being able to apologise for having made a mistake in what he said." With regard to the American system, I should be very sorry indeed that we should go almost without play, as I fancy they do at Annapolis. That is a point I should not desire to copy. There are many other points also. I have no doubt they may be suited to the peculiar circumstances of the country, but that is no reason why we should servilely copy them, although the results they produce is a great reason for examining their system as well as that of the French, and taking those parts which are fitted for our needs. Then, with regard to the American system, there is one other thing. Some gentleman, I forget exactly who now, recommended that Officers should first go to sea, then return home, and have a year's instruction after having been a couple of years at sea. That was tried in the American Navy and it failed; and it was that failure which induced them to have recourse to their present system. Therefore I do not think that would be a desirable course for us to follow. There is one point which Captain Colomb referred to which I should like to reply to. He was kind enough to approve of most parts of the scheme, but I think he said, and Captain Brent said also, that they disagreed from me in what I said about the Lieutenants of the watch of the present day. I am exceedingly glad that they have disagreed in that and that they have brought the subject up, because, although I myself do not concur in what I there stated, I felt bound to state it, because it has been laid before the country in a paper presented to Parliament by a First Lord of the Admiralty. I may say that presentation was uncalled for, and I am therefore particularly glad to have elicited an adverse opinion, and to say that I entirely

share in the opinion which is adverse to that statement. That statement first appeared before the Channel Fleet in a shape that was particularly odious to it. I think also that Captain Colomb did not quite understand what I said about making the Navy a scientific service. My words were, "I have been told it is not desirable to make the Navy a scientific service. We are far enough from that, we are safe from any danger of that sort." What I meant was not at all that I did not wish to make the Navy a scientific service, or that I did not wish to raise some scientific Officers; but I thought we were so far from anything of the sort that we need not trouble ourselves about that at present; because what we are discussing is the preliminary education of naval Officers and not the higher staff education which I wish to keep clear of, and which I have no doubt will be put before us before the end of this year in a much better shape than I can pretend to do. At present we have no system of higher education. We have our Naval College at Portsmouth, to which Officers go when they want to spend a little time, some profitably and some easily; but they are not Officers you would select for staff education. The Officers whom one would collect for staff education are those who have already distinguished themselves in some branch of the service, and who want to increase their knowledge of that branch; not those who wish to make up for the time which they have lost in the early period of their career, but those who having already attained to some proficiency are willing to undergo a severe examination in order to enter upon a fresh course of study, and so to make their labours of real advantage to the service. In connection with that point I should like to say that I entirely agree in all that has been said as to the advantage of promoting the studies of Officers in the particular branches of knowledge they take particular interest in.

Captain Dawson and also one or two other speakers thought that in my scheme I gave too much time and attention to mathematics, and not enough to seamanship. I particularly wish not to dogmatise at all as to the scheme I propose. I wish to make it rather hazy and indefinite, because I should be exceedingly sorry to be asked to be a pope in such matters. Therefore, I leave it for discussion and future consideration by people who have had these subjects closely under their eyes for many years, and are much better able to apportion the time of the boys under instruction than I am. But as a matter of fact, I have apportioned about 90 days in each of the two first years to seamanship actually in ships at sea, and we know that the Channel Squadron under favourable circumstances, is not at sea so long as that; and while the youngsters of the Channel Squadron are dawdling about the decks, I propose that the boys should be engaged in a variety of manoeuvres under able instructors during the whole time they are on board ship taking their cruise. I was particularly glad to receive the approbation and concurrence of Captain Osborn in the remarks which he was kind enough to make, because I believe that nobody has thought this subject out so independently as he has. Indeed since I wrote what I have said about Greenwich to the Committee on higher education, I have been told that I have trespassed on his ground; for I believe he long ago thought of the same scheme, and put it before that Committee. I also agree with what Admiral Ommanney said about the advantage of the surveying ships. In the surveying ships Officers were made navigators and surveyors, and they enjoyed advantages which they never did in the regular cut-and-dried routine of ships in a squadron. Captain Beamish certainly hit a blot in the administration of the service at present, in complaining of the boys not being attached so long as they ought to be to the same ship. As he says, and I have a large experience of it, the boys are shipped away in the most strange manner. One does not know why they have gone, or where they have gone. They come with no attachment to their ship or to their Captain; and they go away, I will not say with less, but with as little. Captain Field in the remarks he made objected a great deal to public school training, and objected particularly to the amount of Greek that is taught at the public schools. I quite agree with him in what he means to say. We see the education changing day after day. In some of our public schools a modern course is introduced, so that boys do not necessarily follow the old monkish course which has been handed down from time immemorial. In that modern course I think it would be important not to omit Latin. Our English language is of so peculiar a structure that I think

it is a great advantage for a boy's mind that he should study a language which is, so to say, complete and immutable, and which is, therefore, a better vehicle for the education of a boy's mind and for the formation of his style, than any modern language we can put before him, and, certainly, very far better than English. Having said that, I do not think there is the least necessity for him to learn Greek, certainly not to make Greek verses as we used to do at Westminster in former days. There was one point which I omitted, which Commodore Rodgers was kind enough to refer to. He supposed that I advocated the retention of the youngsters on board a floating college. I have always preferred that they should be in a college on shore. There are so many arguments against a floating college, that I do not think I need recapitulate them. I may tell the meeting by Admiral Ryder's permission, that when about 42 Captains were called upon to give their opinion as to whether a college afloat or ashore was best, out of those who answered directly to the question, 23 preferred the college on shore, and only one preferred the college afloat.

MR. SPENCER BUTLER: When was that?

Captain GOODENOUGH: In 1863. Out of the whole number of 42, 39 thought some college was necessary, two thought that no college was necessary. I think that evidence is very conclusive. I had a very interesting conversation the other day with Mr. Inskip, who has so ably conducted the studies on board the "Britannia" for so many years. He showed me some documents and tables which he had drawn up, which are exceedingly interesting. They establish what I have observed always with boys and seamen, that attainments and good conduct almost always go hand in hand. That is to say, of those boys who have passed out of the "Britannia" with first-class certificates, very much fewer quit the service from misconduct or from any other cause than those in the second and third class. Again, of those who pass out of the second class, very many more remain to the service than those who pass out of the third class. He has exhibited that by an ingenious diagram. It shows what has been done by education; and it shows that the education, as far as it has gone, has been exceedingly advantageous, and that the examinations of the "Britannia" are an exceedingly good test of what boys are to be in after life. It was the consideration of such circumstances as these which led me to feel that in dealing with the "Britannia," I should deal with her tenderly. She has been an admirable institution as far as she has gone; she has been in admirable hands; her commanders and instructors have been very good; therefore, we should deal very tenderly with her in making a change.

THE CHAIRMAN: It will only be necessary for me to make a few remarks. Captain Goodenough quoted me with regard to "some questions" that were sent by me to all the captains afloat a few years ago; the answers bear upon the point before us. I will first tell you why the questions were sent. The "Britannia" had been in existence as a naval college for a very few years, and there was an effort made at head-quarters, on economical grounds, to get rid of the institution. At my request I was permitted by the First Lord, whose private secretary I was, to ascertain from the captains afloat what were their opinions of the training on board the "Britannia." The answers you have heard from Captain Goodenough. A very important return, which had lately been moved for in the House of Commons, by an Officer in the Navy, enabled me at the same time to trace back what had become of the youngsters who had joined the old college which was closed in 1837; what had become of the youngsters who entered in the interregnum of twenty years, between 1837 and 1857, when there was no naval educational establishment, and also what had become of the "Britannia" boys who had entered since 1857. The result of the inquiry was as follows, and it will be well to bear it in mind, because it is quite possible that mischievous changes may even now be made on the score of economy; that the temptation may arise again in the minds of those who are at the head of our Service to suppress the training-ships. If such a change is made, it will be in the face of the following remarkable results of my inquiry, viz., that while the old college existed in our younger days, previous to 1837, only 10 per cent. of the youngsters who passed through it, had vanished from all causes before they were twenty years of age. During the interregnum, when there was no college or training-ship—no "sieve," 30 per cent. left for various reasons, misconduct, disgust, &c.

When the "Britannia" was established we returned to the old 10 per cent. This was considered so conclusive a proof by the First Lord of that day of the value of the "Britannia," if only as a sieve, where the lads were daily for 12 months under the eye of a carefully-selected captain and experienced naval instructors, one of whose chief duties was that of "weeding out rubbish," that he determined to retain the "Britannia," and sent her to Dartmouth, adding a second line-of-battle-ship to increase the accommodation. I regret that I failed in my endeavours at that time to have the whole establishment transferred to a college ashore with small training ships. The process I have just described, viz., that carried out in the "Britannia," by a judicious captain and careful naval instructors, while retaining the lads under this supervision for a considerable time, viz., the "sifting out of the rubbish," the useless or deleterious youngsters that would otherwise have gone into the Service to the great injury of their companions, is an immeasurable benefit, even if there were no other advantages. I agree in everything that Captain Goodenough has proposed to-day, with, however, one qualification, which I will state presently, but must remark, that I do not think the present system, imperfect as it may be, has really ever had a fair chance, and I am afraid it never will have, notwithstanding the efficiency of the naval instructors, and I never had other than a good naval instructor in any ship I have served in. People in authority have not until recently shown any but the most languid interest in the question of Naval Education, Mr. Childers, the late First Lord, whose resignation has, in this respect at all events, been a loss to the Service, has taken the lead in trying to wake up this long slumbering question of naval education. What opposition he met with, and was in a fair way of surmounting, we shall probably never know; but I hope and trust his successor will take as much interest in the matter as he did. I repeat the statement that the old system has not had a fair chance. Captains received no encouragement to look after their youngsters' education. Ships were paid off, and no notice was taken of the youngsters' forwardness or backwardness; there was no test applied when ships were being paid off to ascertain whether the boys had been carefully taught, therefore the captains, not unnaturally, in the majority of cases, did not pay any particular attention to the education of their youngsters. They paid great attention to their ships being in good gunnery order, and to their being smart in evolutions aloft, to cleanliness, and to discipline; but they paid, as a general rule, very little attention to the special education of their youngsters, either as seamen, as navigators, or as Officers, because the Admiralty did not appear to care about it; on the contrary, there was a prejudice on the part of many old Officers against it. They might not say as much, but they evidently quite believed it, and thought that the attempt to improve the education of our youngsters must result in preventing them from becoming good seamen and smart Officers, and held apparently that a good Officer and Seaman was a heaven-born intuitive genius who would be cramped and stunted by education. The present system might have had much better results if it had had a fair chance. But on the whole, and under all the circumstances of the case, I recognize the absolute necessity for a change. The qualification, subject to which I for one accept Captain Goodenough's proposal, to make 15 the average minimum age of entry, refers to the existing system of nominating naval cadets. I do not believe that with the vicious system of nomination that at present exists we shall ever be able to secure the good results that Captain Goodenough looks forward to. What is the present system of nominations? Having been private secretary to a First Lord, the Duke of Somerset, I had at one time a great deal to do with these nominations. The First Lord nominates about two-thirds of the whole number. What does the First Lord know about the youngsters that he nominates? As an almost universal rule, nothing. Has he any time to find out where they are at school, or how they have behaved at their schools? certainly not! He probably has never seen any one of these boys, and probably never will see one of them in the course of his life! Therefore, there is no sufficient check upon the class of boys that come into the Navy through his nomination. In spite of this vicious system of nomination, the lads turn out better than might have been expected. But we do not, as a general rule, get the best boys this country can produce, whereas we ought to have the very best; the

boys that come to grief in the Navy do so because there has been no care taken in the previous selection, the tests being merely physical and intellectual, and because very little care is taken in their after education at sea after leaving the training-ships. I am firmly convinced that previous selection will be most effective and satisfactory if the boys are entered *chiefly* from the public schools; I do not say *entirely*, but as regards the larger number. 140 "nominations to compete" are given away every year now, and of these 70 are finally entered. I would be content if 100 "nominations to compete" were given to the public schools. Four nominations have been given annually to the naval school at New Cross, and one has frequently been given to the "Worcester" and "Conway" training ships. The principle has, therefore, been admitted of giving nominations to public schools. Whatever may be the means adopted for selecting the lads, whether by aid of the masters of the public schools or by some other machinery, I repeat, that if you want to obtain the best boys in England, the best suited for our service, you will find the widest area of selection and the best raw material in our public schools. Those lads who are thus selected by some machinery, competitive or otherwise, at the public schools, will, of course, have to compete at Greenwich as at present with other lads who have obtained nominations. As to the question of learning Greek, there is in most public schools a "modern side" where Greek is omitted, although Latin is taught, and for the reasons so well stated by Captain Goodenough. From my experience of the public school-boys I have met occasionally in the Navy and elsewhere, I am convinced that they are exactly the best description of raw material for our special needs and requirements. There is something in the atmosphere of our English public schools that prepares the boys to be good Officers. Therefore if some system of selection can be devised, and I see my way to one, it would be desirable, in my opinion, to draw largely from the principal public schools, including, of course, Marlborough, Haileybury, Cheltenham, &c. I know by my own experience, that First Lords have found the present system of nominations a great nuisance, and if it could be got rid of and some good substitute provided, they would, I believe, be only too glad for their own sakes and that of the service. As patronage—political patronage as it unavoidably becomes—is given up in many of our public departments, I hope it will be swept away in the Royal Navy, and that the nominations will be given mainly to public schools. It must be remembered that at many of these public schools the education is much cheaper than at most good private schools. Assuming, then, that the vicious existing system of nomination by "my Lords" is to be altered, I readily accept Captain Goodenough's proposal to advance the average age of entry to 15, but if the system is not altered, then I hesitate. If I am not sure of obtaining the *best* description of boys, viz., from the public schools (and the field of selection is not wide enough at public schools until the boys are 15), then it may be better to continue to obtain boys for the Navy at as *early* an age as possible, viz., 13, because we shall then have them longer under training, and have a better chance of getting rid of the trash early, or of polishing the indifferent material we shall continue to receive. Captain Goodenough has drawn our attention to the "central" portion of the large question of naval education, and has given us an admirable paper upon it; previous however to the important question treated of so ably by him, viz., on the question of *preliminary* education after joining the Navy, there is the hardly less important question of *early* education previous to joining the Navy, which I hope will for the future be secured by drawing our supply chiefly from the public schools. *Second* in order stands the question of "*nomination*," which I have touched upon. *Thirdly*, "*preliminary education in the Service*," Captain Goodenough's question: and, *fourthly*, there remains the *higher* education of the Officer after he has reached the age of 19, which has not yet been discussed in this theatre. These four points include, I think, the whole question of the education of the young naval Officer. I return the thanks of the meeting to Captain Goodenough for his most interesting and valuable paper, which may I trust be a starting-point from which we may date a great change in the treatment of a question second to none in importance, whether we regard it merely as a professional matter of interest only to naval Officers, or in its wider aspect as a national question.

LECTURE.

Friday, March 31st, 1871.

FIELD-MARSHAL H.R.H. THE DUKE OF CAMBRIDGE, K.G.,
G.C.B., Commanding-in-Chief, President of the Institution, in the
Chair.

ON AID TO THE SICK AND WOUNDED IN WAR.

By Lieutenant-Colonel R. J. LOYD-LINDSAY, *W.C.*, M.P., Chairman of
Central Committee, National Society for Aid to the Sick and
Wounded in War.

FIVE years ago a lecture was delivered at this Institution by Dr. Longmore, C.B., Professor of Military Surgery at the Royal Victoria Hospital, Netley, on the Geneva Convention, and on National Committees for aiding in Ameliorating the Condition of the Sick and Wounded of Armies in time of War.

The interesting narrative which Dr. Longmore gave in his lecture, of the circumstances which led to the Congress in 1864, and of the Treaty which resulted from it, turned people's attention for a short time to one of those remarkable movements which spring up in the world from time to time, and are frequently claimed by individuals as of their own originating, but which, in reality, arise from a general and simultaneous *growth* of public opinion in a particular direction, but which individuals are often enabled to concentrate and unite in a practical form. Such was the character of the movement which originated in Switzerland, and led to the Congress of Geneva. A somewhat similar case is seen in our Volunteer movement, the implanting of which amongst the institutions of the country is stoutly laid claim to by at least a dozen rival, but unfortunately equally unappreciated, originators of the force.

The conviction which results from the study of history from the earliest period down to the year 1871, offers no escape from the conclusion that as long as men are born into the world, constituted as they are by nature with instincts both for good and for evil, which soon develop into feelings representing rival interests and rival objects, which can only be attained by striving, one man against another, so long will wars and rumours of war continue to prevail among us.

Believing, therefore, in the continued prevalence of war among nations, some men have turned their attention to plans and schemes which have for their object the softening of sufferings and sorrows

which fall upon those who, although not themselves responsible for war, are necessarily the most severe sufferers from its effects.

Perhaps there is no time in which the value of money is more personally brought home to men than when life and limb are threatened by disease or accident, and when through its agency the resources of science can be brought to the aid of suffering humanity.

The noble institutions which abound in this country, many of which owe their origin to the benevolence of former generations, and their usefulness and efficiency to the constant and present devotion of the most scientific and skilful physicians and surgeons of the community, furnish to the poor man freely and gratuitously all these extra chances of restoration to health and strength which are enjoyed by the rich.

For generations these institutions have stood among us as monuments of civilisation and humanity, and they should be regarded with feelings of pride and satisfaction by those who watch for the gradual but permanent growth of goodness and benevolence among mankind. At the very period of the foundation in London and Paris of many of these hospitals and institutions, the establishment of which proves that civilisation and humanity were moving men's minds and thoughts in and around their homes, the most barbarous and cruel indifference to the wants and sufferings of the soldiers who were fighting their country's battles abroad, was almost universally displayed.

The journals and records of the French military surgeons in the Peninsular War abound in admissions that the greater part of the wounded usually perished for want of help, and there are not wanting records of the miserable condition of the sick and wounded of our own Armies also during those campaigns. Going back to earlier days, we hear of the time when the sick and wounded were habitually abandoned in the towns and villages, and even on the road-side, and on the battle-fields, in which the State never even recognized its obligation to assist them.

More merciful and humane ideas than those which I have described, have indeed long existed among nations and among their rulers, but it has taken time, which may be measured almost down to the present generation, to recognize fully the absolute obligation which rests upon nations who send out armies to fight their battles, to provide such assistance both in *personnel* and *matériel*, as will lessen the sufferings which must befall those who chance to become the actual victims of war.

We appear to be now living in times when wars are made by nations in arms and when all able-bodied men, however peaceful their vocations in life may be, must be conscious that the time may come when a rifle or a sword may be thrust into their hands, and they may be called upon to fight in the ranks of an Army with no higher grade than that of a private soldier. We need hardly, however, imagine ourselves placed in this position to induce us to do all that trouble and expense can accomplish, in order to secure for the regular soldiers of our Army the best chances of recovery should they be struck down by wounds or by disease.

It is now an admitted fact that any provision which Government can

maintain for the service of the sick and wounded in time of peace is invariably inadequate to meet the enormously-increased demands which instantly spring up at the commencement of war. The great problem which Governments are now endeavouring to solve in their Armies, is how to constitute their ranks in such a manner as to be capable of rapid expansion and of rapid contraction. How to have large reserves of men ready to serve when wanted, and ready to return to their own employments, independent of Government support, when not thus required.

The difficulty of satisfactorily solving this problem for the Army appears likely to baffle at least the Government of this country, but the difficulty of solving the problem of that which relates to the service of the sick and wounded, does not appear equally difficult of solution. A slight sketch of what has been done during the recent war between France and Prussia by the English National Aid Society may serve to illustrate its procedure.

The Society has worked by means of the machinery supplied by the Articles of the Geneva Convention. These articles may be classed under two heads: 1st, the formation of National Committees in co-operation one with the other; and 2nd, the Privilege of Neutrality which is afforded to those working in aid of the Sick and Wounded in War. Before proceeding further, it may be well to remark that the Geneva Convention appears rather to contemplate that National Committees should aid their own armies and not those of foreign nations; and it must be observed that the National Society would have found less difficulty in its operations had it been working in aid of an English Army instead of assisting those of France and Germany. The sudden outbreak of a war, in expectation of which those two nations had been preparing and arming for years, took diplomatists and statesmen in this country entirely by surprise. Nevertheless, within a month of its declaration, more than a million of men were under arms and closing in upon one another. The accounts which reached this country of the improved weapons of destruction; the famous breech-loading rifle, never before used on both sides in a war; the newly-invented mitrailleuse; the enormous masses of artillery; all tended to prepare the minds of men for a contest more gigantic and more destructive to life than any which had taken place within the memory of man.

The nature of the quarrel which sprung up between these rival nations left England as neutral and impartial in her feelings as the greatest admirer of the Peace Society could possibly desire, but that very impartiality favoured the display of sympathy and concern for the fate of the many thousand sufferers who must fall victims to the war.

On the 4th of August a Committee was formed, of which His Royal Highness the Prince of Wales was president, and Her Majesty the Queen soon after became patroness. The illustrious Duke, the President of this Institution, also gave his name and sanction to the Committee. A Ladies' Committee was also formed, of which Her Royal Highness the Princess Christian of Schleswig-Holstein was the Chief. One of the first acts of the Committee was to place itself in com-

munication with Her Majesty's Government, in order to obtain official recognition, and in order that the aid which the Society proposed to send out to the sick and wounded might be transmitted with the sanction of Her Majesty's Government.

On the 4th of August Mr. John Furley, one of the earliest advocates of the adoption of the Geneva Convention in this country, and who was only second to Captain Burgess, our most indefatigable secretary at St. Martin's, left England at the request of the Committee to visit the President of the Geneva Committee, and also the members of the Committees in Paris and Berlin. In order to ascertain from them the precise mode in which the assistance of the newly-formed English Society might best be given, Mr. Furley reported, "I spent six hours in Paris, four in Geneva, and twelve in Berlin. As I passed through France the news of the first Prussian victory had not yet arrived, and at Geneva the earliest reports of French reverses gained but little credence. The frequent telegrams, however, which a few hours later reached Lausanne, Berne, and Zurich, would not admit a doubt. All the steamers on Lake Constance were gaily decked with flags, and at night bonfires and rockets on the German shores testified to the joy of the inhabitants. In the early morning of the 8th, in answer to the summons which rang forth in every spire along the hill sides and through the valleys of Bavaria, hundreds of men and women, and children, were to be seen wending their way to the various churches to join in a general thanksgiving."

The battle of Wissembourg had been fought, and the result was that hundreds of wounded men were being carried to the rear, and long trains of prisoners were seen on their way to the fortresses of Germany. The battles of Woerth, August 6th, and Forbach, rapidly followed one upon the other, and on the 21st August Sir Henry Havelock wrote as follows from Pont-à-Mousson:—"It makes me sick at heart to see the scenes of suffering that cannot be relieved, first for want of proper appliances and aid, next because the surgeons are too few for the work. All the French wounded have fallen into the hands of the Germans, and they have been treated like their own people, without the slightest distinction of nationality. Some of them have told me 'Nous avons été soignés comme si nous étions des frères, par ces autres.' It is lamentable to see the mass of human suffering here. The two sides have left nearly 20,000 wounded in German hands, and there are actually numbers of wounded here struck on the 16th and 18th (to-day is the 21st), who have only had their wounds dressed on the field when hit, and never since. You know well what suffering this entails. It is simply impossible to do more for want of hands and of appliances."

At this time the London Committee were overwhelmed with letters and suggestions, passionate appeals from home and from abroad, and strong remonstrances at the want of immediate aid being forthcoming on the field of battle. Five years before Dr. Longmore had predicted in this room, in the lecture to which I have alluded, the precise thing which occurred. He said, while urging the formation of a National Committee in England: "If this remains undone, you will be at a dis-

"advantage. Committees will be formed, subscriptions will pour in, "but, as heretofore, there will be an absence of system and independence of action."

Fortunately there was one marked difference between the circumstance under which we were working from that which Dr. Longmore thought might arise; we were working in aid of foreign armies, and not with the weight of responsibility of having an army of our own in the field.

The Committee sprang into life under the influence of accounts of suffering which had already commenced, and which had to be dealt with by arrangements which were neither preconceived nor systematized. Prompt and rapid action was necessary, and the Geneva Convention afforded machinery which was found ready prepared to our hands.

That the Geneva Convention has worked beneficially in aid of the sick and wounded is universally admitted. That the articles of the Convention have been abused and require extensive alterations cannot be denied. A reliance, somewhat too extensive in its character, was at first placed in its Rules, which were in many cases neither understood nor recognized by the belligerents. The surgeons who were sent out at the special request of the French and Germans were unrecognized and unemployed, because they were not properly accredited as members of the Society. There was no means of obtaining the sanction of those in authority for our surgeons to give aid, neither was there any means of obtaining proper information as to where to give it; nevertheless, the spirit of those who went out on the business of the Society overcame these difficulties. "Every person whom we met," said Mr. Hart and Berkeley Hill, "employed on the business of this Society was animated by the same excellent spirit. Ready to do anything which would serve the objects for which they were despatched, ready, in the case of surgeons, to undertake the most arduous responsibilities in the case of large numbers of severely wounded men, often under most serious disadvantages as to shelter, attendance, and food; equally ready to lay aside scruples of professional etiquette, and to work under the direction of men both junior and of less firmly established professional reputation than their own."

When quoting the report of these gentlemen, it is, however, fair to add that many parts of this report are not so favourable to the working of the Society as that here given. The full report will be found in the "Times" of the 8th October, and I would only further remark that its general tenor goes to show the necessity of having preparations systematized and organized on a well-considered and preconceived plan, and I sincerely trust that some public spirited persons may be found willing and ready to undertake this task, which may be somewhat assisted by the experience gained in this recent war.

Towards the close of the month of August, the subscriptions to the National Society amounted to about £30,000, and the Central Committee at that time reported that they had 40 surgeons serving under the Red Cross Society, engaged in the field, or at the hospitals formed

in France and Germany. The French authorities had not only laid aside all distrust, but had gratefully accepted the co-operation tendered them by the English society. On the 26th August Dr. Frank, who had been sent out as the representative of the Society, writes from Paris:—"There seems every hope of our being able to start for the north on Sunday, and if we really should succeed in doing so, I shall be amply rewarded for the weariness and disappointment at the days spent in this place—days utterly lost, as far as the real aim of our mission is concerned." And then he adds, "In the long run they may prove not to be badly spent after all." And so, indeed, it turned out, for on that Sunday there left the Palais d'Industrie a body of men animated with an amount of enthusiasm which carried them through the most arduous and trying times of the campaign. The history of the Anglo-American ambulance is a history of relief rendered to the wounded at the most critical period of the campaign, on the battle field, and under actual fire. Neither hardship nor danger ever diverted the surgeons of both nations from their noble duties, and to the end the most uninterrupted respect and confidence existed between the members of the Staff. On leaving Paris, Lord Lyons laid special stress on their operating in French territory.

In Germany, the Committee had entered into an alliance with the German Aid Society, and established a joint international field hospital at Bingen, on the Rhine, constructed on the modern system of tents and isolated huts, which, whenever adopted during this war, has proved so highly conducive to the well-being and recovery of the patients. But the vicissitudes of war caused Bingen to be somewhat too remote from the actual scene of conflict for its capabilities to be as fully utilized as had been anticipated. Indeed, the operations of the Society throughout Germany have been necessarily of a somewhat different nature from those carried on at the actual theatre of the war, and have consisted chiefly in sending out supplies of *matériel* and aid in money to the numerous hospitals throughout Germany, to which wounded and sick men were sent in such vast and continuous streams as almost to exhaust the efforts, energetic and well-sustained as they were, of the various local native "Aid Societies" and Committees. The English National Society has proved of great use in supplementing these efforts. It commenced its operations by dispatching Captain Douglas Galtou, C.B., accompanied by Mr. H. T. Bonham-Carter, on a tour of inspection of the hospitals of the Rhine district; in the month of September Dr. Mayo was subsequently appointed chief surgical representative of the Society in that district, and the hospital constructed by him at Darmstadt, chiefly for the reception of patients suffering from typhus and other diseases, has achieved highly satisfactory and successful sanitary results. Though still under Dr. Mayo's active management, it is no longer under the control of the Society, having, in the month of February, been handed over to the charge of the German authorities at Darmstadt. The state of the wounded on the Luxembourg frontier was during the latter part of August, truly heartrending. They had neither bread nor water, and even the surgeons could not stay with them for lack of the barest means of sub-

sistence. The slaughter often happened in the manner and at the place least foreseen, and no sooner had stores of food and surgical instruments and appliances been sent to one place, than they were instantly required in another. The mass of French wounded in particular who were accumulated on the German borders, induced the Committee to concentrate its force, and make Luxembourg its chief base of operation. This neutral island in the midst of the storm of war, was thought likely to afford a most advantageous situation from whence to carry aid to those who had been wounded, and were lying on the battle fields round Metz. The exertion of the agents of the Society was most praiseworthy. They opened communication by road with carts and horses, carrying out food, and bringing back the wounded into cover and shelter; but with all their exertions the carnage was so enormous in its extent, that their organization was able very slightly to relieve the suffering. Meanwhile, the affairs of the Society at home had assumed a very different character from that which they originally bore, when the utmost expectation of the Committee was bounded by a hope that they might be able to send out some surgeons and nurses to give supplementary aid to the field and permanent hospitals in France and Germany, and likewise to furnish some surgical instruments, medicines, and disinfectants, such as chloroform, and carbolic acid—things which, from the circumstances of the war could best, and, perhaps, only be obtained in England.

But, as was said at the time, greatness, at least of work, was thrust upon the Committee. Meetings were held in every part of Great Britain, and the public, reading day by day the history of the war, with all its harrowing details so vividly described by the writers of the English press with the armies in the field, were unable to confine themselves to mere words of sympathy, but showed their feeling by contributing both in money and *matériel* more largely than has ever previously been done at any former period.

The constitution of the Society at this time was briefly as follows:—A Central Committee and a Ladies' Committee were assembled in a block of three houses, lent them by Government, in St. Martin's place; Local Committees, the sources from which aid in money and *matériel* were chiefly received, were formed in almost every town and district in Great Britain. The functions of those working at St. Martin's naturally divided themselves into two departments, viz., that which related to gifts in goods, and that which related to contributions in money. The Ladies' Committee controlled and managed the former, receiving, unpacking, sorting, repacking, and acknowledging things sent, making known the chief requirements abroad, corresponding with Local Committees, keeping statistics of material aid received. To this was added the management of the vaults and store-rooms, and the direction of the storekeepers and packers. The deliberative and administrative business of the Society was in the hands of the Working Committee, who selected and dispatched the agents abroad, and controlled, within certain limits, their conduct and procedure; they received deputations and letters, and afforded information to subscribers concerning the Society's operations; they dealt with requests from existing

foreign societies for supplementing resources and gave them assistance to carry on their work. This, together with securing facility of transport for persons and goods through districts broken and disturbed by war, formed some of the duties of the Central Working Committee.

To carry on a well-developed and widely-embracing scheme of operation such as would give proper and adequate results in return for the large sum of money which had now been paid in to the funds of the Society was the object of the Committee, and with that view Captain Brackenbury, of the Royal Artillery, was attached by the Secretary of State for War, at the request of the Society, to their service abroad.

Captain Brackenbury started on the 7th September to represent the Society and control their operations between Metz and Mezieres and the district of the Ardennes, along which line of country the great battles of the campaign were being fought. Luxembourg was found unfavourable for a chief depôt on account of the Douane regulations which impeded the work at the Society more than can be told; and Arlon being in Belgium, where the same impediments were not cast in the way, and being also on the main line of railway communication, was wisely chosen as the chief depôt for the stores and head-quarters of the Society. Captain Brackenbury wrote on the 6th September:—
“Already Mr. Furley has made our Society specially marked by his
“great exertions and the success which has attended them. It only
“wants that the individual efforts going on should be completely
“organized, for which my powers are sufficient, to let it be seen what
“gigantic efforts England is making to relieve the misery which, by
“all accounts, is almost unspeakable.”

The Archbishop of Canterbury on the 10th September addressed a letter to the Bishop of London, saying, that it seemed to him that the time had come when there ought to be a general collection in all the churches to aid one or other of the Societies for the sick and wounded. The response which followed the publication of this letter was instantaneous throughout the country. Fortunately, as it seems to us, these and other contributions were entrusted mainly to one Society, thus securing what Dr. Longmore urged five years ago in this room, viz., a system of united, and not of independent, action.

On the 17th September there were 110 persons engaged in the service of the Society. Of this number 62 were surgeons, 16 were ladies acting as nurses to the sick and wounded, and the remainder were classed under the head of agents, who were giving their services, some being paid and some unpaid.

The surgeons were employed as follows:—

At Sedan, attached to the Anglo-American ambulance, under the direction of Dr. Simms (United States) and Dr. MacCormac, with about 400 wounded French and Germans, 14 surgeons; at Balon, about 200 French and Germans, three surgeons and two ladies; at Douzy, five surgeons and one lady; at Briey, three surgeons; at Chalons, one surgeon; at Stenay, two surgeons; at Beaumont, four surgeons; at Donchéry, one surgeon and two ladies; at Bouillon, one surgeon; at Darmstadt, four surgeons; at Saarbruck, one surgeon; at Metz, two

surgeons; at Pont-à-Mousson, one surgeon; at Autrecourt, two surgeons; at Arlon, three surgeons; at Bingen (hospital under joint management of German and English), 12 surgeons; at Hanau, two surgeons; at Köln, one surgeon.

The above is an approximate statement of the distribution of the Society's surgeons, who were necessarily moving from place to place as need arose.

The agents who were working under Captain Brackenbury in the district of the Meuse and the Ardennes were 32 in number.

The above-named district having been dealt with in the manner described, a similar organization was prepared, to commence operation from Saarbruck at the first moment when the capitulation of the French Army, which was being besieged in Metz, should be brought about by the famine, disease, and sickness, which were long known to be gradually overcoming the strength and courage of the French soldiers; but before proceeding to this second stage of the Society's operation in this district I must describe what was going on in the North of France under the guidance of General Sir Vincent Eyre, whose head-quarters were at Boulogne-sur-Mer. As the tide of war did not reach this part of France till later in the campaign, it will be sufficient to state that at this period a visit of inspection was made by the General and two of his Committee to the towns of Amiens, Arras, Douai, Lille, Cambrai, Avesnes, Maubeuge, Charleville, Valenciennes, Saint Omer, and Calais, and smaller towns, the names of which I need not enumerate. Nearly every hospital and ambulance established in these places was inspected, and the most minute enquiries were made from those in charge, who were requested to select from the English National Society's printed list (of which translation had been prepared in French) such articles as they particularly needed. This they accordingly did, Sir Vincent Eyre advising the Committee in London by post and telegraph of what was needed. At least fifty French ambulances, containing an aggregate of some 6,000 wounded, were thus assisted in the course of this tour by the Society's Visiting Commissioners.

At Arras Sir Vincent Eyre writes that surgical instruments were particularly wanted. There was only one set of amputating instruments in the whole town, and much unfortunate delay in the performance of the most necessary operations was the consequence. English lint was greatly coveted, as also were oil-silk, woollen socks, flannel shirts, and quinine.

It should be known that the German and French surgeons infinitely prefer English lint, and only use *charpie faite de mieux*. English surgeons all detest *charpie* and use plain clean rags instead where lint is not to be had. Surgical instruments were always asked for, and the amount sent out by the Society amounted to £10,345 4s. 11d. in value. The supply of instruments abroad was soon exhausted, and could not be replaced except from England, from the fact of those engaged in making them on the Continent having become soldiers in the ranks, and to this difficulty was soon added the closing of all communications with Paris, to which city the whole of France habitually looked, not only for medical and surgical supplies, but even for the ordinary

necessaries of life. Waterproof sheeting, and fabrics of that class, and drugs, such as chloroform, are far better in England than abroad, and hence the demand which was made upon us for this class of goods. The value of these things sent out during the campaign amounted to £8,505 7s. 10d.

A French Officer of artillery expressed his gratitude at Arras to Sir Vincent for the services rendered him at Sedan by one of our English surgeons, who dressed his wounds and took care of him. As many thousands, both French and Germans, passed through the hands of our surgeons, it may be supposed that a feeling of gratitude to the English nation will rest in the hearts of these poor fellows for the amount of care and tenderness which they everywhere met with in English hospitals, and from English agents.

I alluded a few minutes ago to the departure from Paris, on the 28th August, of the Anglo-American Ambulance. On the 11th September, just a fortnight afterwards, Dr. MacCormac, whose recent appointment to the staff of St. Thomas's Hospital I look upon with pleasure and satisfaction, wrote as follows:—"We have witnessed the utter downfall of the Grande Armée of the Rhine, the capture of an Emperor with his 80,000 men, 300 pieces of cannon, 60 mitrailleuses, and 90,000 stand of arms." He goes on to describe how the ambulance got into position and into working order on the eve of the great battle which was fought on the 1st September. How the Caserne d'Asfeld in Sedan, with its 384 beds, was made over to him and his colleague Dr. Simms, while Dr. Frank became accidentally, or rather providentially, separated from them and established a branch hospital at Balan, where in the Mairie he placed himself and carried on operations during the battle, being compelled at times to lie flat down beside the wounded and dying to escape the shot and bullets which were coming in at the roof of the house. The work done at the Caserne d'Asfeld was as follows:—

Wounded, inscribed and registered, including a few sick	593
Sick and wounded not registered, but moved in hospital	200
Wounded, dressed, and attended to, and extern patients, during the battles of the 31st August and 1st September	400
Total	1,193

As yet we have no precise account of the work done at Balan, where there were no less than 400 cases and many operations.

From the Caserne d'Asfeld, MacCormac writes:—"We have about 60 cases of amputation and several of resection of the upper extremities. Some of them have been done in other ambulances. Yesterday we had a number of tents pitched, capable of holding 120 beds. We have wonderfully healthy wards, but they are overcrowded. Yesterday we had a visit from the Intendant-General. He was much pleased with our arrangements, excepting the open

"windows; at that he stood aghast, protested strongly, and told us "a *courant d'air* like that would kill our patients. In the last three days 3,500 wounded have been sent out of Sedan, but the place seems "as full as ever. Every second house has the red-cross flag flying "over its door." Dr. MacCormac gives an account of an operation, which I hope I may be excused for repeating, as it shows the value of chloroform. He says, "The other day at Balan I assisted Frank "with an amputation of the thigh of a poor Chasseur, who had just "been brought in. His thigh had been badly smashed the first day of "the fighting, and he was left to lie in a ditch for five days afterwards without succour. Neither had he tasted food all that time. "As gangrene was imminent, amputation was decided upon. The "first thing Lyon asked for, for that was his name, was a cigar, which "he smoked with great zest until he was being put under the influence "of chloroform. After the operation, and on regaining his senses, he "requested permission to finish his cigar, as he would not like to "waste it, and he might as well utilize the time until they were ready "to operate. It was difficult to persuade him all was finished. For "some days this brave young soldier went on well, but tetanus set in "and his recovery was despaired of." During this time there were grave complaints in letters from abroad of the cruelty of the rapid evacuations of the badly-wounded soldiers, when their condition and weakness was such as to render their transport dangerous to life. The weight of testimony, however, is abundantly on the side of rapid removal from the vicinity of battle fields. "The principle of "isolation," Dr. Murray says, "If carried out well, cannot be over-estimated, but proper means of transport would diminish the "mortality greatly. The ordinary country carts which were used did "not afford protection from cold and wet, and did more injury by "jolting." I am tempted to give a few lines from a letter written by Mr. Furley on the 12th September. He says, "You know how "bravely and conscientiously the British Medical Profession always "do their duty. I wish, however, all the members of the National "Committee could have heard from the self-sacrificing nurses at Balan, "as I did yesterday, their testimony to the zeal, patience, and persevering labours of our chief in that village, Dr. Frank. His presence "is sunshine in every room he enters, and his subordinates, who so "ably and willingly support him, will always, I am sure, feel proud of "having worked under him." Mr. Furley goes on to give a little history which is most touching in its character. He says, "While at "Balan yesterday, a packet was placed in the hands of one of the "surgeons. This consisted of a pocket-book, a cross of an officer of "the Legion d'Honneur, together with a note in pencil; both the "pocket-book and the note are pierced with a bullet, but the name and "address are fortunately preserved, and the *souvenir* will, as soon as "possible, be forwarded to the widow.

"*Sedan, 1st Sept.* Au milieu de la bataille entouré par les balles je "t'adresse mes adieux. Les balles et les bullets qui m'épargnent "depuis 4 heures ne me ménagerons pas plus longtemps. Adieu, ma "femme bien-aimée; j'espère qu'une âme charitable te fera parvenir cet

" adieu. Je me suis comporté bravement et je meurs pour n'avoir pas voulu abandonner nos blessés. Adieu, un baiser."

Dr. Simms, U. S., Dr. MacCormac's colleague, in his report to our Committee, gives such strong testimony to the value of women nurses that I feel bound to quote what he says:—"As nurses, I would not exchange one woman for a dozen men.

"From the moment that women were introduced as nurses, the whole aspect of our establishment was changed. Only last night a poor wounded soldier's life was saved by one of our lady nurses in a most remarkable manner. It is well known," he says, "that gun-shot wounds are often followed by secondary hemorrhage from 10 to 20 days after the wound is received. We had great trouble in arresting a bleeding of this sort. It took two hours to do it. One of our lady nurses, Miss Neligan, stood by aiding us all the time. During the night, when all slept, Miss Neligan remembering three or four badly-wounded men in her ward, and fearing that some such accident as she had just witnessed might occur to them, went quietly round, and, gently examining them, found, to her horror, that one of her patients was lying in a pool of blood still gushing forth in a great stream. Instantly she stanchd the blood by compression, and called up the doctor in charge, who permanently arrested the bleeding. Five minutes, and the man would have been dead, while the stupid men nurses were snoring, fast asleep."

With regard to the organization of ambulances, Dr. Simms writes as follows:—

"The *personnel* of the French ambulances were too numerous. They had an expensive retinue of infirmiers which might be dispensed with in a great degree. I would organize an ambulance as follows:—One surgeon-in-chief, two or three surgeons, dressers in proportion; three or four women nurses. I would pick up infirmiers whenever and wherever they were needed. In time of war there are idle men enough out of employment who are glad of occupation. It would be better to send out several small ambulances thus organized than one too large and unwieldy."

Drs. MacCormac and Simms thoroughly agreed upon the important subject of free ventilation and the use of disinfectants. The wide windows on the sides of the building were never closed, and the wind swept through the wards all the time from S.W. to N.E. Carbolic acid was freely used. Carbolic lotions constituted the dressings in all cases. Free ventilation and carbolic acid kept the wards sweet, notwithstanding the immense crowd of seriously wounded. No one was allowed to suffer pain if morphine hypodermically, or chlorodyne, or other form of opium could control it. No one was allowed to pass a sleepless night if chloral could procure rest.

It was a gratifying thing to pass through the wards at 10 or 11 o'clock at night and find 350 poor sufferers all quiet and sleeping soundly, and Dr. Simms adds, "What precious boons to humanity are morphine and chloral."

Towards the middle of October this stage of the Anglo-American

Ambulance came to a close by the return of Dr. MacCormac to England, Dr. Simms having preceded him by a month.

Early in October it became apparent that the fortress of Metz could no longer hold out, and rumours of the approaching capitulation of Bazaine, at the head of 100,000 men, who were being reduced by sickness and famine, caused the Society to make the most strenuous exertions to prepare an organization for that district, similar to that which had been so successfully established at Beaumont, Duazy, Balan, Bazielles, and Sedan. Hitherto the drain on the resources had been so great in dealing with the wants of this district that comparatively little had been done in the Metz neighbourhood; but Drs. Ernest Hart and Berkeley Hill had rendered valuable services by inquiring into, and reporting upon, the condition of things, and these gentlemen, though not agents of the Society, took the very greatest trouble on its behalf. Dr. Hardwick also assisted in paving the way for the arrival of Captain Brackenbury, who took up his head-quarters at Saarbruck, leaving Mr. Reginald Capel in charge of the Arlon dépôt, from which place he still continued to supply the needs which remained at and around Sedan.

On the 4th October Captain Brackenbury reported that within a few days he trusted to be in a position to say that all the sick and wounded, French and Germans, in the whole circle round Metz, would have all the comforts they required.

Metz, and a considerable district under range of its guns, was of course still unapproachable by friends or foes. A hospital for 100 beds was established at Saarbruck and placed under Drs. Junker and Rogers, also at Briey Dr. Hirschfeld was placed in charge of about 60 beds. The work of the Society was often greatly aided by various members of the order of St. John, the Johanniters, who mustered in strong force at Saarbruck. This Society has an admirable organization, framed before and during the Austrian War of 1866, and perfected by the experience derived therefrom. The members are men of rank and position in Germany, and are said to have good influence with the Government and with the military authorities.

Captain Brackenbury established most friendly relations with these Knights of St. John and with their chiefs, Count Konigsmarck and Herr von Jreskow. Dr. Sandwith, who was one of the first to offer his services to the Society, and who did good work in their behalf in this very town of Saarbruck previous to the organization under Captain Brackenbury, also speaks in high terms of the kindness shown him by Prince Hohenlohe, and by Baron Ompteda; but notwithstanding the most friendly relations which existed between the societies, it was found necessary to maintain on the part of the English Society a complete independence of action on account of a fundamental difference existing in the objects and intentions of the subscribers to the Fund. The Johanniters gave from their stores to the troops (under arms, as well as to the sick and wounded) and no doubt contributed greatly thereby to the health and fighting power of the regiments of the North German Army. This was precisely what the people of Berlin, Munich, and Dresden desired, but it was not for that object that the

English people subscribed their money and sent in their gifts to St. Martin's-place.

When Marshal Bazaine capitulated at Metz on the 27th October, the English fourgons were the first on the scene, carrying the relief which was so much needed, and returning to Remilly with wounded Officers. Captain Brackenbury reported here about this time as follows:—"I cannot tell you with what pleasure I look on our work here. The first to enter Metz—the first to give succour—the first also in liberality, our Society has here taken the true place which England's generosity entitles us to assume. No one can know the misery we relieve; no one can over-estimate the blessings which are showered upon us for our work."

The French *Société de Secours* at Metz paid our Society a great compliment; they asked Captain Brackenbury to distribute their stores for them, showing thereby the confidence they had in his impartiality and judgment.

One of the questions which gives rise to much discussion and controversy, is that which relates to dépôts and their constitution in time of war. To have the stores at hand, and the means of conveying them where they are wanted, are the necessities which all people acknowledge to be of the first importance; but owing to the vicissitudes of war, it is far from improbable that a dépôt established to-day may become useless to-morrow. Surprises and changes are essential to military operations, and anticipated arrangements are precisely those which frequently fail in their aim and object. Again, the size of dépôts is a matter about which there are different opinions and much controversy. Small dépôts scattered about are wasteful, inasmuch as the tide of war may never flow near them (the Society was urged to form dépôts in all sorts of places), while large dépôts are apt to become places where goods are buried and lost for want of classification and arrangement. Witness the store-rooms of Balaklava. The plan adopted by Captain Brackenbury was to establish principal dépôts as at Arlon and Saarbruck, with advanced dépôts at Briey and Remilly; as time went on, and the war spread, to them were added more advanced dépôts at Charleville, Chalons, Chateau Thierry, and Meaux. This last-named place became, through the circumstances of the war, one of the most important stations at which the work of the Society was carried on. Working as the English Society did, with a resolution to add nothing to the burdens which fell upon the population of the invaded districts, it was necessary to be furnished with all things needed for the conveyance of stores, such as carts, waggons, and horses. These things had to be bought or hired at war prices, and as many as fifty waggons were employed in supplying the hospitals round Sedan alone when the wants were most urgent. As the Society's stores became known, requisitions poured in from Prussian, French, Bavarian, and Belgian ambulances, and these were invariably complied with.

By the end of September a sum of nearly £200,000 had been raised in money alone, besides contributions in goods, the value of which it is difficult to estimate. The subscribers to the Fund perceived that

the extent of the need surpassed all precedent, and was beyond the power of any ordinary means of relief. The work of the Society could not keep pace with the eager desire of people at home to see their contributions carried to the help of those armies, where the slaughter had been equally sudden and enormous. The Committee determined therefore to give £40,000 for the benefit of the sick and wounded of the French and German nations, making it a distinct and honourable obligation on the part of their chiefs to apply the money exclusively to the purposes above stated. The Committee entrusted to me the duty of carrying this large contribution in equal portions to the Germans at Versailles, and to the French in Paris.

Without entering into a history, I may be allowed to state that, in the course of my journey in a carriage between Havre and Paris, I passed a dozen times through the outposts of the French and German armies, that I was never detained five minutes, except when passing the barricades outside the besieged city, and that the Red Cross Flag was generally saluted both by soldiers and peasants along the whole road.

I merely relate this as being, in my opinion, a remarkable instance of the working of the Geneva Convention, without which it would have been impossible for me to have made the journey through towns and villages which were being alternately occupied by German and French soldiers, and by *Frances-Tireurs*, whose discipline and organization was somewhat similar to that of the banditti in Greece.

The permission to enter Paris was accorded me by the King of Prussia, and I was able to carry assistance to the sick and wounded in the besieged city at a time when it was most acceptable and grateful to the French nation.

Soon after my return to England the following letter was received from His Royal Highness the Crown Prince of Prussia :—

“Head-quarters, Versailles,

“November 2nd, 1870.

“The noble contribution brought by Colonel Loyd-Lindsay, for the use of the sick and wounded, from the English Society of which he is the director, deserves somewhat more than a simple acknowledgment.

“On this, as on other occasions of distress, the help of the English public has been poured out with a liberal and impartial hand.

“The gifts which have been offered in a truly Christian spirit, have excited a feeling of heartfelt gratitude amongst those in whose name I speak. In doing so I am repeating the feelings of the whole of my country people, in this instance represented by those for whose special benefit these gifts are destined.

(Signed)

“FREDERICK WILLIAM,

“Crown Prince.

“To Colonel Loyd-Lindsay, V.C., &c.”

It afforded a gratifying assurance to the subscribers that this kindly feeling and generous liberality were justly appreciated by those at

the head of the German Army, and indeed by the German Army itself.

During the time that I was at Versailles, viz., 11th and 12th October, very severe fighting was going on near Orleans. While at the headquarters of the Crown Prince, the messenger arrived bearing the news of the defeat of the French Army of the Loire, and of the victorious entry of the Bavarians under General Von der Tann into Orleans. The Germans were subsequently driven out of Orleans, and here it was that the French obtained the only marked success which befell their arms during the whole campaign.

The battles of the 8th and 9th November resulted in the retreat of Von der Tann, and the French army, under General Aurelles de Paladines, took up its position across the Loire, at Orleans and Chateaudun. For a very brief period it looked as if the French were about to retrieve their fortunes. Their army was a larger one than that which marched under McMahon to Sedan. It had a powerful artillery, and was composed chiefly of old soldiers, who had been liberated from service, but had been recalled again to the ranks. With all this, however, we have at present no concern, save inasmuch as it relates to the sick and wounded, who, even more than usual in this campaign, were left destitute of the barest necessities for preserving life. The French surgeons had neither chloroform, nor medicines, nor surgical instruments, and many of the amputations had to be performed with butchers' knives and common saws.

The English Society was fortunate in obtaining the services of two most able and indefatigable representatives in this district of France, viz., Colonel Elphinstone, C.B., and Mr. S. S. Lee, an American gentleman living at Tours. These two gentlemen have been up to the present time, and are still, unwearied in their exertions to relieve the sufferings of the wounded soldiers. I despair of being able to record a hundredth part of all they did in the unhappy district around Tours and Orleans, where oft-recurring battles have turned into a desert the most fertile part of France.

Colonel Elphinstone and Mr. Lee were especially successful in the establishment of a railway station soup kitchen at Tours, where wounded men passed through in vast numbers, arriving every night by hundreds at the station, where they were carried in or hobbled along themselves, without arms or legs, a terrible army of martyrs. Colonel Elphinstone or Mr. Lee were at the station every evening, with hot soup, coffee, and bread. It was impossible to describe the gratitude of the men who had had nothing to eat all day, and nothing warm for many days. On looking back to the work of the Society, there is nothing more satisfactory to my mind than the records of the distribution of nourishing food and sustenance given to the exhausted suffering wounded soldiers, who were being moved in long trains of trucks and waggons, travelling day and night, exposed to the weather, and with nothing given them but a biscuit and some water to drink. The restaurant at Forbach, near Metz, which was maintained by the English Society, in conjunction with the Johanniters, supplied, during the month of October and part of November, about 19,500 sick and wounded with wine, coffee, and food.

and exchanged the rags of the poor men for warm clothing, socks, drawers, &c. The poor soldiers, especially the French, frequently fought without having tasted food, and, if wounded, often remained for days, with nothing more nourishing than a piece of dry bread to eat.

Miss Elizabeth Garrett, who was at Sedan about the middle of September, on her return home, amongst other practical suggestions, mentioned this one to the English Society. Railway station kitchens were established by Captain Neville at Meaux. At this last place, besides the sick and wounded, French prisoners arrived from all parts, and, after hours of agony and hunger, were sent on by trains to Germany in open trucks, and these trains were so often shunted, that they took between five and eight days to reach Nancy, the prisoners never leaving the waggons, and exposed, night and day, to whatever weather chance might send, and to hunger, reaching almost to starvation. Captain Neville received such pressing demands, that he yielded, and provided a large supply of food for these positively starving men. Again, at the battle of Querrieux, near Amiens, on the 23rd December, Colonel Cox established an extempore cooking place in the field. He says, "Our ambulance was the only one which had brought out any sort of comfort for the wounded, beyond surgical requisites, and fortunately we were able to supply every demand made upon us by the medical men." This prompt administration of food and stimulants within the first few hours after receiving a wound, and before removal to hospital, is often of more value and importance even than surgical attendance. It is a point much neglected in the Prussian service, where too much reliance appears to be placed in surgical aid alone, unsupported by the valuable help of such auxiliary comforts as it has been the special aim of our Society to supply. The experience we have acquired at the above-mentioned battle of Querrieux, and elsewhere during the campaign, shows that such aid can be provided, even on the actual battle-field, with the most advantageous results, at comparatively small cost or trouble. It has been estimated that, with such extra comforts, 30 per cent. more of the severely wounded would survive, than if left to ordinary French and German hospital diet.

The slight sketch which I have endeavoured to give of the work done by the National Society would be even more incomplete than it is, were I to omit to mention the departure from England, with some of its subsequent operations, of the ambulance which generally went by the name of the Woolwich Ambulance, and which was fitted out under the Director-General of the Army Medical Department, aided by Dr. Longmore, Professor of Surgery at Netley. This officer, whose experience and knowledge of matters connected with the transport of sick and wounded troops, and whose interest in the working of the Geneva Convention has made his name known almost as much abroad as at home, was to have headed our ambulance as a medical director, but falling ill just before its departure, much to the grief of all parties concerned, he was unable to undertake the duty.

The ambulance left Woolwich for Havre on the 14th October; its organization and equipment was complete for 200 patients, with hospital

marquees, bell-tents, bedding, and cooking apparatus. Besides these arrangements for a permanent hospital, it was equipped with all things necessary to enable it to take the field, with 8 ambulance waggons, 12 store waggons, furnished with operating cases and surgical dressing-cases, medical comforts, preserved meats, biscuits, &c. The *personnel* consisted of 12 medical officers and 27 hospital corps men, the whole being under the command of Dr. Guy, Deputy Inspector-General of Hospitals. The route chosen for the ambulance to reach Versailles was through Havre, Rouen, Mantes, and Vernon. It reached the head-quarters of the German Army, investing Paris about the last week in October.

The medical officers were allotted a building at St. Germain, where they took charge of 200 patients, who were suffering from typhus and dysentery; but owing to difficulties which arose in the course of frequent visits by the German Medical Inspectors, who perhaps naturally enough required a subserviency to their own *modus operandi* in the management of the patients, an abrupt termination was put to this form of aiding and assisting the sufferers in the war. The whole of the bedding and stores necessary for the comfort and support of the patients was made over to the German authorities, (and the English medical officers were withdrawn from the care and treatment of their former patients, who were immediately taken charge of by the German doctors.

The field equipment now came into operation, and the Woolwich Ambulance was divided into two parts. Dr. Manley, V.C., who had become second in command, owing to Dr. Porter's illness, received on the 11th November an order to take charge of a division of the ambulance, and to proceed to Chartrel, where, in consequence of the repulse of the Bavarian Army from Orleans, it was expected that important operations would shortly take place. Dr. Manley joined the 22nd Division of the Prussian Army with the following staff: Assistant-Surgeon McNalty and Assistant-Surgeon Moore, together with one sergeant and four men of the Army Hospital Corps, with the 22nd Division of the Prussian Army. He continued to march in a westerly direction, and on the 18th the ambulance was present at an engagement which took place at a village named Forçay; the waggons were taken forward, and the stretchers brought out, and the wounded collected. The ambulance waggons were then ordered to proceed to Chateaufort, where an hospital had been established. It was nine at night before the ambulances were cleared of the wounded, and the following day they were again engaged in carrying in wounded, the Prussians putting their serious cases into the English waggons, as being steadier and less liable to jolt than their own. On the 20th the division moved on, and on the 21st they were again engaged near Bretoncelles, where the ambulances again did good service. On the 2nd December a general action took place at the village of Bagneux; an English hospital was formed at a farmhouse, in the village of Auneux, which was soon filled with wounded, even to the stables and outhouses. Dr. Manley caused the canteen to be prepared, and coffee and milk was served out to every man in the village before his wounds were dressed. The fight had been long and exhausting, and the cold extreme, and this treatment was

most beneficial. After this refreshment the wounded were attended to, and the more important operations proceeded with in the farmhouse kitchen. Whilst still operating at ten o'clock at night, the General commanding the division came and begged that the waggons might be again sent to the field, as there were numerous wounded not yet brought in. His request was immediately complied with, and it was not till three in the morning that all the wounded were brought back. At daylight, coffee and soup, made from extract of meat, were again served out, port wine and brandy being also given when needed. For some days after this the English ambulance was working in the surrounding villages, where as many as a thousand wounded men were congregated. Surgeon Manley calls attention to a great defect in the German medical service, to which I have already alluded, viz., that no arrangements are made for giving nourishment to the wounded, either on the field of battle, or immediately after they are brought in. In his opinion this ought to rank in importance before the dressing of wounds. The work during all this period was most severe, and Surgeon Manley gives great credit to all there, both officers and men, who worked under him. The message which he received on one occasion from General Von Wittisch shows that the services rendered by his ambulance were thankfully received and appreciated by the Prussian Commanders. "Receive," said the General, "our heartfelt thanks for your "most valuable aid, given to us in the moment of our great need, when "our own ambulances were not forthcoming."

A second division of the English ambulance, under the command of Dr. Guy, proceeded on the 1st of December, under orders of the Prince of Hesse, to Beaune-la-Rolande, where they took under their charge the whole of the French wounded, who were scattered throughout the town. Besides this work his waggons were continually employed in transporting wounded French and Prussians.

A third division, under Dr. Ball, was placed in charge of the wounded who had been left at Pithiviers, about 14 miles from Beaune-la-Rolande, and subsequently was installed in charge of a large ambulance, in the old château at Blois.

The three divisions of the English ambulance were supplied with stores from the dépôt of the National Society at Versailles, which was under the management of Mr. Young, Commissary-General to the Ambulance, and of Mr. John Furley, who has been from the commencement an active agent of the Society abroad, and who is now engaged under the French Peasant Farmers Seed Fund Committee in relieving the wants of the farmers round Paris.

On the first statement of the sufferings of the French prisoners of war in Germany, the Society sent out Lieutenant Swaine, of the Rifle Brigade, to act as their agent in the districts where prisoners of war were confined. Lieutenant Swaine carried with him warm clothing, to the amount of £6,000, which he has distributed in the most methodical manner at Magdeburg, Cologne, and other places. His letters to the Committee bear testimony to the good treatment which the prisoners of war receive from the Germans. He states that at the places he has visited, the men all agree that they are as well off as they have a right

to expect; and he himself adds that never were prisoners so well treated. The Committee could add more evidence to the same effect.

With a similar object, and furnished with similar stores, the Society sent Captain Harvey, of the 71st Highland Light Infantry, to visit the German prisoners in France. At Belle Isle the greatest number of prisoners were confined; of these a large proportion were merchant seamen, whose hard fate it was impossible not to feel pity for. Many had been captured in August, and had lost their ships and all their property, and a great many first learnt the news of the war having been declared by being taken prisoners.

In the course of the lecture which I have been allowed to deliver, and to which you have been kind enough to listen, I have endeavoured to show, in the form of a narrative, the mode in which aid has been given to "the sick and wounded in war." I chose this form in which to treat the subject which I have been asked to lecture upon, because I thought that people would be more likely to be interested, and perhaps instructed, in the subject before us, by hearing of that which actually has occurred, rather than by listening to a lecture built up upon theoretical speculations. Now in the narrative which I have very imperfectly given, and which in no way pretends to be complete as a report of the work of the Society, there have been questions touched upon from time to time which are of both interest and importance. The manner in which these questions have been dealt with and solved under practical circumstances, I venture to think is worthy to be placed on permanent record. Casting my eyes back over the pages I have read, I find that the following subjects have been more or less touched upon. The Geneva Convention has been shown to have worked beneficially; and indeed without it much could not possibly have been done which has been under its protection accomplished. The Articles have been sometimes abused, and the terms of the Convention not always adhered to. Soldiers and civilians who were not very actively engaged in the service of the sick and wounded have sometimes used the badge very freely, and the belligerents have not shown proper strictness in requiring the production of the badge or brassards. To avoid this inconvenience every accredited member of the Society should have a card, properly printed in the language of the belligerents, bearing the name and rank (in the Society) of the owner. This card should be properly stamped with a device or words which should be recognized and acknowledged by the authorities of the contending forces, and copies of this should be lodged with the chiefs of the Society, who should also receive a nominal roll of all members sent out in the service of the sick and wounded. When a society of a neutral nation desires to come to the assistance of an army in the field, it should in the first instance send out a chief agent with precise instructions as to the character of aid which the neutral contemplates being able to furnish. This assistance must, of course, consist either in providing surgical aid, or in providing stores such as food, surgical instruments, drugs, warm clothing, &c. In the late war both these forms of assistance were given, and both were welcome. The first, I should say, was most in accordance with the subscribers' intentions; the second was certainly the most

welcome to the belligerents. The medical authorities, both French and German, preferred stores to medical service, of which they were sometimes jealous. This jealousy of foreign assistance existed even when the aid was most needed. It was, of course, immediately after a general engagement that surgical aid was most required, and then the advantage of it was beyond all price, and well worth giving, even at the cost of days and days of idle waiting.

However, it will have been seen in the narrative which I have read that the most satisfactory work which was done by the Society was done *not* by isolated surgeons tendering their skill and services to the already existing French and German hospitals, but rather by complete ambulances under the sole management and control of the Society and of the Society's surgeons. Doubtless this system has proved the most satisfactory in its results, but it must be borne in mind that it is costly in its character and requires to be supported by large funds, which might not be forthcoming at a future war. Sending out surgeons and nurses, on the other hand, could be accomplished at a small cost. I think, however, I may venture to state as my opinion, that surgeons and nurses sent on roving commissions in the present state of the Articles of the Geneva Convention would be of little useful service.

The best size and organization of an ambulance has been incidentally shown in the course of the story of this war. The greatest amount of work compared with the cost was invariably obtained by such sized ambulances as that under Dr. Manley at Orleans, that under Dr. Frank at Eperney and Balan, Drs. Simms and MacCormac at Sedan, and Dr. Yunker at Saarbruck.

The French ambulances were shown to be too large, and their *personnel* too numerous. From four to five surgeons, including dressers, with as few hospital corps men as possible, was found the most convenient strength.

Infirmiers (as hospital corps men are called abroad) were found to be a constant source of trouble and annoyance. In the German Army these men are invariably drawn from a superior class of people, and are much better adapted for their duties than either the French or English orderlies, who are old soldiers with no aptitude or taste for attending on sick and wounded men. I believe there would be no difficulty in England in finding men of cultivation and position who would undertake the duties of infirmiers in times of war. And at a time when much attention is being bestowed to the training of female nurses, this is surely also a point worthy of consideration. I am fully alive to the superiority of female nursing, and no system of relief to the sick and wounded in time of war can be in any measure complete or satisfactory which does not include this most important element. But the proper place for women-nurses is in the more permanent field hospitals in the rear of the armies, not on the battle-field itself. In the actual following of an army on its march, a staff of men-nurses, or infirmiers, is essential—the presence of women on such occasions being more embarrassing than useful.

During this war, the National Society has sent out comparatively few nurses, not from any doubt as to their zeal and efficiency, but from the

fact that the supply of trained native nurses, belonging chiefly to religious communities, both in France and Germany, has been so great as to render foreign aid in this respect in most cases unnecessary. The French *Sœurs de Charité* have, notwithstanding occasional exceptions, shown themselves admirable nurses: tender to the sick, with neither crotchets nor theories to work out, with barely any personal requirements, simply doing their duty, under direction, with loving patience and faithfulness. They have proved the great importance, or rather absolute necessity, not only of medical and surgical training, but of habits of obedience, of unity, and of discipline. It is this special training, a training hitherto found difficult to enforce, except under some kind of religious rule, which rendered the All Saints' Sisters the most valuable and efficient of the English nurses sent out by the Society; and it is the absence of such training that renders the efforts of amateur nurses, however devoted and energetic, for the most part desultory and ineffective. I do not deny that exceptions may, and have during the present war, been found; but the very qualities which have distinguished these ladies would, under a more organized system of training, have achieved even greater results. The superintending and giving out of stores opens another and a most useful field for female labour, and in our dépôts at Tours, at Boulogne, and Amiens this work has been principally carried out by ladies.

Again, the value of nature's remedies, viz., air and food as opposed to medicine, in the old technical sense of the term, has been continually shown, and yet it is singular that prejudice stands in the way of the one, and bad economy prevents the free use of the other. The miraculous effects of fresh air have been fully exemplified, and its strongest advocates have been the English surgeons engaged in the war. The most spacious palaces—and many of these have been used—are less suited for the reception and care of badly wounded men than the temporary buildings erected of wood or canvas. The less there is between the patients and the outer air, and the greater the facilities of carrying the wounded actually into the open fields, the better are the chances of their wounds healing quickly and of their health returning. The advantage of the free use of disinfectants, especially carbolic acid, for purifying the wards, and for washing, when diluted, the wounds, has been shown, and will, I trust, never be forgotten.

The urgent demand for surgical instruments, and the great supply sent out by the Society cannot fail to have been noticed. Many suggestions for economy were made, and some were adopted, with a view to repairing and resetting instruments which had become blunted by use, and stones for sharpening were sent out, but the most practical plan was to take back into store the blunted instruments and replace them by new ones. The expense of sending out cutlers with grinding stones would have been great and the results doubtful.

The experience gained by the Woolwich Ambulance, and especially the division under Dr. Manley (which took part in the campaign after the repulse of Von der Tann from Orleans) will, I am sure, be of use to the medical service of this country. Some question of practical interest will be placed far on the road to solution by the reports which

he has made, and by the information which he can give. On such matters as the best mode of collecting the wounded off the field of battle, and on the most convenient form of ambulance waggons and stretchers, he has given me some interesting details. He says that the vehicle which he thinks best adapted for the transportation of stores is one made after the model of the Prussian commissariat waggon, the advantage being that when fully loaded, it can be drawn by two horses, that it has a permanent roof which can be locked, and so the stores which it contains are rendered safe from loss when left unguarded or unprotected.

On the value of giving food and sustenance, he gave the best evidence by what he and his colleagues did at the battle near Bagneux, and since he has come home he has said that a good, prompt, and efficient system for supplying stimulants and nourishment to sick and wounded in time of war is of as great importance as proper surgical treatment. The lack of these requirements appeared to him the one blot on the otherwise most efficient medical service of the Germans. The following is a short account which Dr. Manley has kindly given me, from his own observation, of what takes place in the German Army for the transportation of the wounded from the field to the waggons, from the waggons to the field hospitals, and thence to the hospitals in the rear. The regimental surgeons accompany their regiments into battle, and to every 250 men there are three *Kranken Tragers*, who accompany the regiment into action, and are supplied with and know how to use the necessary field dressings. This has proved to be a most judicious regulation, for of all the arrangements of the Prussian medical service, that of the corps of *Kranken Tragers* is the most perfect, and ought to be adopted into our service. The way in which these men do their work and the rapidity with which they remove the wounded from the field, is most commendable and worthy of imitation. Immediately after an engagement, the *Sanitats* detachment, which includes a staff of Medical Officers, the *Kranken Tragers*, and the ambulance waggons, all under the command of a *Rittmeister*, who is generally a Captain in the service, and who has a Lieutenant to assist him, is ordered to advance on to the field by the surgeon of the division under whose command the whole is placed. The stretchers are got out, and the *Kranken Tragers* advance, two men to each stretcher, taking a certain direction and a certain line under the command of the *Rittmeister* and his Lieutenant, accompanied by some of the Medical Officers of the detachment, to collect the wounded as fast as possible and bring them to the place where the waggons have been halted. The Surgeons who have remained with the waggons proceed to apply the primary dressings and get the wounded into the waggons. When the waggons are full they are immediately dispatched at a slow and steady walk to the nearest house or place which has been designated as a temporary hospital, and over which the Geneva flag is immediately hoisted. The ambulance waggons are unloaded as quickly as possible and dispatched again to the field at a rapid pace, when all the wounded that can be found have been taken off the field, the line of *Kranken*

Tragers is ordered to halt. The mounted Officers and Non-Commissioned Officers advance and search along the ditches and hedges, and at intervals shout to attract the attention of any wounded men who may have fallen out of sight, listening also to hear if there is any response. When the wounded arrive at the temporary field hospitals they are laid side by side. The surgeons immediately proceed to dress the wounds, and tie to the button of every man's coat a small white card, on which is written a short description of the wound. If the *corps d'armée* has to advance the next day, the Sanitats detachment accompanies it, and the wounded are taken over by the field Lazarettes of the division which is left in charge. Such are the provisions for the care and the removal of the wounded from the field to the field hospital, and from the field hospital to the more permanent hospital in the rear in the German Army—the most systematizing army in the world. In our own Army, since the Crimean war, an Army Hospital Corps has been formed, or rather it has received a new constitution. I believe it numbers about 1,000 men in its ranks, a proportion of these are trained in the duties of carrying and tending the wounded in the field itself and in the hospital subsequently, but, as far as I am aware, no regimental system is provided by which wounded men are collected after a battle and carried to where surgical aid can be given them. Perhaps the Germans may be said to systematize to too great an extent, even down to the most minute matters, but it is difficult to hold this opinion in the face of the wonderful success which has everywhere attended their military operations.

In conclusion, I would beg my kind hearers to understand that what I have read to them in no way pretends to be a report of the work done by the Society abroad. My account is obviously incomplete in all matters connected with finance and precise statement of goods and money supplied to the French and German wounded soldiers. It is merely a narrative of some of the events of the war, in which the National Society took some part and some share not altogether unworthy of the English people, who, in the words of the Crown Prince, already quoted, "have poured out their help with a liberal and "impartial hand." Can we doubt that the same hand would be stretched out as liberally in aid of our own armies, and in aid of those injured in the nation's cause, should we unfortunately be drawn into the calamity of war, and can we wisely or justly decline to do what other nations have done, viz., to appoint National Committees, recognized by Government, whose functions it would be to organize the distribution of the national donations on a sound and proper footing, and thus be prepared to supplement what all admit must greatly need expansion and extension, viz., the medical department of an army in time of war?

Ebening Meeting.

Monday, April 3rd, 1871.

REAR-ADMIRAL THE RIGHT HON. LORD FREDERICK KERR,
in the Chair.

NAMES of MEMBERS who joined the Institution between the 20th March
and 3rd April, 1871,

LIFE.

Brown, James, Lieut. R.N.

ANNUAL.

Hale, Lonsdale, A., Capt. R.E.

Kerr, C. R., Ensign 102nd Regt.

Craufurd, H. R. G., Lieut. R.A.

Noel, G. H., Lieut. R.N.

Jones, Mainwaring, Ensign Hon. Art. Co.

Lyttleton, Hon. N. G., Lt. Rifle Brig.

Swaine, L. V., Lieut. Rifle Brigade.

Malcolm, G. J., Capt. R.N.

Ross, J. C., Lieut. R.E., Bengal.

THE ATTACK AND DEFENCE OF FLEETS.

By Captain P. H. COLOMB, R.N.

I.

The CHAIRMAN: I call upon Captain Colomb to address the meeting on the subject of the "Attack and Defence of Fleets." But previous to Captain Colomb's commencing, I wish to call attention to a notice that has been put up. In these societies it is necessary that we should observe the rules that are laid down for our guidance; and one of the rules here is, that in the discussion after the lecture, *ten minutes only can be allowed to each speaker*. I, therefore, hope that gentlemen who may wish to address the meeting, will confine their remarks within that time.

Captain COLOMB: The subject I have undertaken to illustrate in to-night's paper is one of extreme importance at the present juncture. It is not only desirable that we should find ourselves prepared with some definite views on naval warfare in the open sea, when carried out with the ships and weapons now at our command, but it must never be forgotten that the views we may form will, and do, actually govern the nature of the designs produced by our architects, and the disposition of guns and other weapons on their floating carriages. It would therefore be a culpable error for any one treating of the attack and defence of fleets, to confine himself to questions of manœuvring merely, as though ships were, like men, of an unchangeable type. Writers of the past on the subject of naval tactics, such as De Morogues, Père Hoste, and Clarke, of Eldin, might well be excused if they thus treated their science. But

such a method is no longer permissible. Writers of our age, who assume in some sense to lead opinion, must remember that we stand at the cross roads of naval warfare; we are no longer hedged in by impassable barriers on the smooth highway of progress. Many roads are open to us, and we have to make a selection, guided by a not much better trail than the Indian hunter finds in his forests. I am the more anxious to press this point forward, as I believe we are not sufficiently alive to the fact that the current view on the attack and defence of fleets is the foundation of all design in naval *matériel*. I say I think we are not sufficiently alive to this fact, because I cannot believe, were it otherwise, that we should rest content with certain instinctive ideas on the subject of future naval war, and make almost no attempt to formulate our instincts, and separate where possible the chaff from the wheat. If I were to make the assertion that the designs of our ships arise more out of instinct and tradition than out of any comprehension of how they are liable to attack, and how they are capable of defence, I should at first raise a feeling of incredulous surprise in the minds of my audience. Yet I do make the assertion, and think that a few sentences in explanation will entirely remove the incredulity, while they will strengthen the surprise. Consider for a moment how you could rebut my assertion. What sort of arguments would you use, and what sort of facts would you produce to sustain the counter-proposition that our ships were designed to deliver certain specified and approved attacks, and to offer certain distinct resistances? You would be constrained to rely on the general proposition that the ships were designed to use their guns, and perhaps their rams for attack; and their armour for defence against guns. Beyond this you could not go; and you will observe that it is a very small step. The gun and the ram are presented to your view as possible weapons, because they are both traditional; you cannot build a war ship except on the supposition that she is to use both or either of them. On the other hand your instinctive desire for protection from shot has given you armour plating. In what respect you have advanced beyond instinct and tradition can only be proved by ascertaining whether you appreciate the relative values of the two weapons provided, and have designed your ship in agreement with that relation. Take an illustration from the infantry soldier, which is temptingly apposite to the case in hand. He has two weapons, his rifle and his bayonet. Their relative value is established and known, and no projector would be mad enough to sacrifice one iota of the known value of the rifle to the problematical value of the bayonet. But who can say of any ship in our Navy in which the two weapons are combined, that her gun-power is properly sacrificed to assist her ram as the superior weapon, or that her ram-power is judiciously curtailed to admit of increased ordnance? For clearness of expression, I am leaving out of consideration the third weapon—the offensive torpedo—which it will be necessary hereafter to treat distinctly; but is not my assertion, even in the case of any single ship called upon to attack, or defend herself from any other single ship, quite borne out by the elementary considerations I have adverted to?

If we go a step beyond the single ship, and glance at the preparation

made in our ships for combined attack, or combined defence, we shall light upon a complete abnegation of any such idea.

But returning to the single ship, and avoiding the confusion of the double weapon in the same ship, think what is ascertained as the best method of carrying ordnance? Is the "Monarch" or the "Hercules" the more powerful ship? or would the 5,000 tons of the "Monarch," and her four 25-ton guns, fall victims to the attack of five lightly clad ships of 1,000 tons, each carrying a single 25-ton gun?

Then if the ram be alone considered, what are the relative values of speed and turning powers for attack upon a willing adversary, or for compulsory defence? May speed be judiciously sacrificed to turning powers, and to what extent? Or must speed be secured at all hazards, and turning powers only considered afterwards?

If we are not depending on tradition and instinct, then categorical answers are forthcoming to all these queries. But if no such things are extant—which is unfortunately true—and if besides, very little effort is exerted in the attainment of true solutions, then my position remains unassailed and unassailable.

Now, what I want you to observe in all this is, that while we are very apt to think that the ships and weapons presented to the naval Officer for his uses in a complete state, cause him to take particular views of attack and defence, and give rise to his speculations on the subject; yet the converse of this is the case. He first forms views of attack and defence, and these find expression *afterwards* in material products. It is the abstract gun, ram, and torpedo, which form his original ideal of warfare; the concrete weapons do no more than modify views already outlined in his mind. If his original ideal is crude, unthought out, above all, if there are diversities of ideal, the results in a material form will give rise to vague uncertainties, and endless discussions, such as those by which we find ourselves now surrounded.

It will be seen, therefore, that from my point of view I could offer you no more important or comprehensive question than that I have chosen as the title of my paper.

I had no sooner plotted out what I thought should be said on an occasion like the present, the facts it would be necessary to put forward, the deductions it would be proper to draw, and the general line of treatment it would be desirable to pursue, than I became overwhelmed with the magnitude of the task before me. For just observe for a moment what a paper on "the attack and defence of fleets" might be expected to deal with. Think in what aspects a professional audience might justly call upon me to place the subject before them.

There would first be the theory of the matter. You would expect me to set out the theoretical relative values of the gun, the ram, and the torpedo, as offensive or defensive weapons. Each must, therefore, be carefully and separately considered, and then considered afresh in their relation to each other.

It would next be proper to look at the state of naval opinion at home and abroad on this question of relative value, and to note how it might coincide or differ with the conclusions independently arrived at. The ultimate conclusions, whatever they were, ought then to be applied

to the combat between single ships of existing types, and from the whole discussion should be drawn the deduction as to how present ships fulfil the ideal requirements so far.

I do not think I exaggerate when I say that any discussion of the attack and defence of a fleet is absolutely valueless prior to the analysis I have sketched out, but it is apparent that analysis would fully occupy the limits of a single paper.

The next step in the enquiry would be the theoretical methods of making a fleet mobile and flexible under the control of an Admiral. The state of naval opinion at home and abroad should be applied here, as it was to the values of the weapons, and compared with the facts.

After this, you might fairly call upon me to consider the offensive and defensive features of the various formations proposed or possible, and of the movements by which they are obtained; and here it would be necessary again to glance at the state of naval opinion on this head. Then, and not till then, should we be in a condition to place ourselves in the position of a fleet attacking, or a fleet attacked, and so deduce the rules within which we must act to give the greatest vigour to our attack, and the greatest solidity to our defence.

In facing these conditions which seemed to me unavoidable, I had to consider how I should meet them. I might touch very lightly and inefficiently on each branch of the subject, and compress the whole of it so greatly as not to extend the limit of time allowed, but I felt it was not just to so great a subject, so very casually studied, to treat it in that cursory way. If I had had any further doubts about it, they were fully resolved when I found that I had written enough for an hour and half's reading, and had not so much as touched the fleet question at all!

Therefore, to my great regret, I come before you to-night under the false pretence of a misnomer in title, "The Attack and Defence of Fleets," has dwindled to the attack and defence of single ships, and if I receive your censure at the outset for my acknowledged short comings, I shall hope to modify it by showing at the conclusion that I was a helpless instrument in the hands of my facts.

Without further preface, then I shall proceed with the examination of guns, rams, and torpedoes, in the order and with the objects I have pointed out.

Guns.

In my paper on "Modern Naval Tactics" read here five years ago, seagoing turret-ships were not, and the discussion of the gun-power of a fleet was necessarily confined to broadside ships, whose fire covered an arc of three points before and abaft the beam.

In my "Lessons from Lissa," also read here in 1867, the "Bellerophon" was our representative ship, and the calculations used to illustrate gun-power were drawn from her capabilities.

The "Monarch" is now our representative sea-going ironclad, and she must do duty as our typical ship. In so using her, I am not prejudging the great cause of turret versus broadside, on the contrary, my

opening remarks show that I do not mean to take the "Monarch" as a perfect ship, and consider how a fleet of such ships can be best employed. I take the "Monarch" as my ideal, in order that I may not find myself dealing with an impossible type, and because the "Monarch" embodies in the highest degree the principle of construction and armament most opposed to that found efficient in former naval wars.

All round fire is unquestionably the object to which so much is sacrificed in the "Monarch," and if I were to take a ship like the "Hercules" as my representative, I should find the struggle after all-round fire just as prominent there, but carried out under a smaller departure from old methods of construction. The "Monarch" has the fewest and heaviest guns of any sea-going ship in the Navy, and she exercises her gun-power over a larger arc than any other. She is the embodiment of the idea that the gun is the decisive weapon at sea, to which all others must give place, and that this weapon is most powerful when mounted in limited numbers, of the greatest size, and with the largest arc of training.

The question I propounded four years ago in my paper on the battle of Lissa was, "whether the gun was advancing or receding in power as a naval weapon?" The illustration was whether the guns of the "Bellerophon," as against a "Bellerophon," were more or less powerful than the guns of a 90-gun ship against another of her class before the advent of ironclads. The question to-night is, so far as guns are concerned, the same, but carried a stage further. "Has the 'gun-power of the 'Monarch,' as against a 'Monarch,' advanced or 'receded from the position held by the guns of the 'Bellerophon' 'against a sister ship?'"

In the discussion of the earlier stage, I endeavoured to show by an analysis of the forces at the battle of Lissa, how enormously the gun was falling back before the increasing work it was called upon to do. My comparison was in the first instance, that, under the old system of building and arming ships, each Italian gun would have had only fifty tons of material to destroy in completing the annihilation of the Austrian fleet; and each Austrian gun would have had only 93 tons of Italian shipping opposed to it. With the new methods of building and armament, however, under which the Fleets actually met, each Italian gun had 260 tons of material to destroy, and each Austrian gun 432 tons: that is to say, unless the guns at the battle of Lissa could give shot for shot of the light guns used in former times, and each shot were about five times as destructive, the gun had receded from its place as a naval weapon. I then proceeded to show, that so far from modern guns keeping up shot for shot with their prototypes, their speed of fire was very materially reduced, and that one round in two minutes was as rapid a fire as could be expected.

A Lissa ship opposed to another, gave an average of 346 tons of destructive work.

A "Bellerophon" opposed to a "Bellerophon" gives 600 tons of destructive work to be done by each gun. A "Monarch" opposed to a "Monarch" gives no less than 1,275 tons of work. If, therefore, I had reason in pointing to the recession of the gun from its place as a

weapon, by the results of the battle of Lissa, what am I to say when I find it has now receded three times as far as it had then?

I imagined that guns, then, supposing them to give shot for shot with the old ones, must be five times as powerful to retain their places. Now, on the same principle, I must imagine the "Monarch's" guns to be about twice as powerful as the "Bellerophon's," or about fifteen times as powerful as the old smooth bores, in order to keep their place in the race.

If the "Bellerophon's" plating be considered to have a resisting power of 36, the "Monarch" has a resisting power of 49, which again tells against the guns. But, on the other hand, the "Monarch's" guns exert a striking force of 5,000 foot-tons at 1,000 yards, in lieu of 2,400 foot-tons which the "Bellerophon's" guns exert at the same range. Making a proportion, we find that the power of resistance has increased in the ratio of 1 to 1.3, and of attack in the proportion of 1 to 2. The net result in favour of the guns is 0.7, and, consequently, the net recession of the gunpower since the "Bellerophon's" time, is in the proportion of 1 to 1.3.

Now, it seems that a shot from the 25-ton gun, fired at a range of 700 yards, having on impact an energy of 170 foot-tons per inch of shot's circumference, fails to penetrate the "Hercules" target.

The "Hercules" target is, in resisting force to the "Monarch," as 64 to 49, and the energy of the "Monarch's" shot, at 1,000 yards, is 137 foot-tons per inch of circumference. The proportion between the figures show that the resisting powers of the "Monarch's" side against her guns at 1,000 yards are as nearly as possible equal to those shown by the "Hercules" on the occasion referred to; that is to say, that a "Monarch" firing at another "Monarch," will fail to damage her at 1,000 yards when her shots strike fair.

But how little can we calculate on this result? The general idea concludes that a ship will rarely present her broadside to be fired at. To be fair to both sides, suppose the shot strike at an angle of 45° , and the resisting power of the "Monarch" rises from 49 to 98. In other words, it is doubled. What possible prospect has a "Monarch" of deciding an action with another "Monarch" by means of her artillery, under circumstances such as these?

But we are only on the borders of the "Monarch's" powerlessness as yet.

In my paper on Lissa, I endeavoured to show that at the utmost rapidity possible, the "Bellerophon" could not fire more than 4 rounds per gun in 6 minutes, or 28 rounds in all. I am informed that the "Monarch" does not calculate on a greater speed of fire in action than 1 round in 3 minutes per gun; that is to say, the rapidity has fallen from 28 rounds in the "Bellerophon," to 8 rounds in the "Monarch" in 6 minutes! We have no grounds for supposing that more than a trifling increase of accuracy has been gained, and, therefore, I must debit the guns with this further reduction, equal to 3.5 in their power. If my figures approach correctness, the recession of the power of the gun since the battle of Lissa, as exemplified in the "Monarch" and "Bellerophon," is in the proportion of 1 to 4.8. The guns are

now in point of fact, about five times as weak as they were five years ago.

This seems to me a very startling conclusion to arrive at, and one which lies at the root of all construction and armament. It is not as though it were certain the gun must meet the gun, and therefore the recession was common to both sides of the equation, but it is that some other weapon or weapons are making tremendous strides, and are beating the gun in competition. It may mean also that the manner of constructing the carriage—that is the ship—is at the bottom of the recession. In any case, I can conceive no more important subject for inquiry than whether my figures and deductions are correct. If they are, I can only express my belief that we are close upon a very extraordinary re-construction of our Navy.

Thus far, then, for the relative place of the gun now, compared with that formerly held by it. Let us look at its actual power in view of the future comparison we shall have to make between it and other weapons.

Unfortunately, precise figures are wanting here, and very little attempt has been made to obtain them, as they can alone be obtained by experiment. The inquiry takes the form of two questions: How many shot will strike the hull of a "Monarch" in a given time in the open sea, and what amount of damage will they do? and I must own it has struck me as alarmingly suggestive that I cannot get an answer off-hand to either query. Nobody seems to have made the calculation, even with such data as are obtainable, and no steps have been taken to improve the data. It is true, I believe, that the materials for determining the number of shot which will strike a given vertical target at a given range, when fired from a steady platform, are obtainable, but such a determination must be a very fallacious guide to the results of practice at sea; nor am I sure that even the materials obtained have been applied to determine the practical question.

My figures must be, for these reasons, very imperfect; but I am obliged to use what I can get.

The 12-pounder rifled gun, at an elevation of 2° , is stated to be capable of placing fourteen shot out of every twenty in a target 9 feet square. Speaking roughly, this amounts to saying that two-thirds of the shot fired from a rifled gun are capable of striking a target 9 feet square at a distance of 1,000 yards. Actual practice at Shoeburyness seems to bear out this statement fully; for on firing twenty rounds from the 12-ton gun, the extreme error of elevation at 1,000 yards was only 13.5 feet, and the mean was only 4.7 feet. In direction, the extreme error was 9.75 feet, and the mean error only 4.4 feet. Out of the whole twenty shot, four only would have missed the "Monarch;" two would have fallen short, and two would have gone over. It appears safe to conclude from these figures that the "Monarch" is not liable to receive more than four-fifths of the shot fired at her at 1,000 yards; and if the chances of being hit vary directly as the distance, at 2,000 yards the "Monarch" is only liable to receive two-fifths of the shot fired at her. This is an admission in favour of the guns; for the chances of being hit diminish in a still greater degree; but as the error

given is entirely due to elevation, and the "Monarch," as a target, is very much longer than she is high, the admission may pass.

Under impossible circumstances, therefore, if a "Monarch" opened fire on another "Monarch" at 2,000 yards, she might hit her eight times in ten minutes, but none of these shot would damage the ship in a vital part, and probably would pass through no part of her plating. I use the expression "impossible circumstances," because to get that result, a steady platform, a fixed object, and perfect coolness and deliberation are required, not one of which conditions can be secured at sea in action.

I have tried to obtain some idea of the deductions necessary for each of these conditions; an unsteady platform, a moving object, and extreme rapidity of fire. But it is not easy.

Taking the experiments carried out at Vigo between the "Monarch," "Captain," and "Hercules" for what they are worth, it appears that the three ships fired for five minutes each at a rock distant about 1,000 yards, which was estimated to be 600 feet long and 60 feet high, or twice as long, and four times as high, as a ship. "Hercules" fired seventeen shot, of which ten hit; "Captain" fired eleven shot, and made four hits; "Monarch" fired twelve shot, and made nine hits. Speaking roughly, as I am bound to do with rough figures, it would appear that a ship such as the "Monarch" would, under those circumstances, have been hit three times by the "Hercules," once by the "Captain," and say three times by the "Monarch."

We have seen that .8 of the shot fired would have hit a "Monarch" at 1,000 yards, the platform being steady; we now find from the foregoing experiment that .147 of the "Hercules" shot, .09 of the "Captain's" shot, and .187 of the "Monarch's" shot might be expected to hit her at sea in smooth water, when the distance did not materially vary.

The question for us is whether these figures may be relied on as a guide—whether they fairly represent practice at sea, or either under or over estimate its accuracy. The only other figures at my disposal in order to check the calculation are the following. In some recent carefully conducted prize firing by one of the ships in the Channel Squadron, it was estimated that at from 800 to 1,200 yards there were only 25 lost shot out of 208 fired. A "lost shot" appears, according to the Admiralty circular, to be one which would miss the "Monarch," passing over her either *en ricochet* or directly. The firing on this occasion appears to have been exceptionally good, for a triangular target with 9 feet sides is represented to have been hit no less than four times.

If therefore we are to accept these shot not counted as "lost shot" to be a fair representation of the percentage of hits in a "Monarch" at sea, we shall find it to be .88 of the shots fired. But we have quoted accurate figures showing that at 1,000 yards—a mean of the distances at which the practice under review was carried on—no more than .8 of the shot fired will strike a "Monarch" when the distance is accurately measured from a fixed and steady platform, and the gun is laid with a nicety impossible afloat. This .88 of hits cannot be therefore a true

representation of the practice; and I think naval men generally will admit that observations of the fall of shot taken from the mast-head and extremes of the ship, are, at their very best, of an extremely rough character. The tendency of observers in such circumstances is almost always to exaggerate the accuracy of fire, as I am bound to confess appears to be the case in the details of firing under consideration.

But we have seen that the probable number of hits on a target 9 feet square, at about 1,000 yards, is 14 out of 20. A 9-foot square target gives an area of 81 square feet, while an equilateral triangle with 9-foot sides gives an area of 35 square feet in round numbers. Accepting the assumption that the fall of shot on a given surface varies as its area—which I think will be true enough for our present purpose—we should find that '3 of the shot should strike the floating target in the case referred to. But as 4 only out of 208 struck it, the actual hits were '019 of the shot fired.

Now compare the results of these two investigations. According to the record of "lost shot," this ironclad's practice was really better and closer than that obtained from a steady platform at Shoeburyness; while, measured by the percentage of hits on the target, it was very much worse.

Looking again at the Vigo practice, the average hits of the three ships upon a "Monarch," at 1,000 yards, was '141 of the shot fired, in lieu of the '8 of the shot which would have struck had the practice reached its maximum accuracy. If the prize firing practice had been as good as this, '053 of the shot ought to have struck the floating target in lieu of the '019 of the shot which actually did strike it; in other words, ten hits ought to have been made instead of four.

Artillerists may very likely smile at the rudeness of these calculations and surmises. No doubt they are very rude, but I am not conscious of the endeavour to establish a foregone conclusion of their means, and, dealing with them as rudely as they require to be dealt with, they appear to me to establish the probability that a very much smaller proportion of hits by shot will be made in action at sea than any of us have hitherto imagined.

Is it really then the case that at the moderate range of 1,000 yards, under the most favourable circumstances, a "Monarch" can only expect to hit a sister vessel from twice to fifteen times out of every 100 shot? And if she carries so many as 1,000 rounds of shot, will only from 20 to 150 take effect? This is a question we should not have left so long unanswered, and it ought to be ascertained with certainty without any delay.

I, however, cannot stop to ascertain how the fact may be; I must make a reasonable assumption on the facts I am possessed of, and I take a mean position between the result deduced from the Vigo experiments and those taken from prize firing, and I lay it down that 10 per cent. of the "Monarch's" shot will strike a "Monarch" in action at 1,000 yards.

We have seen that the "Monarch" is, in her vital parts, impenetrable to shot from the 25-ton gun at 1,000 yards when struck fair. Practically, I believe she will be so seldom struck fair, that no part of her

plating is vulnerable until within 1,000 yards, and in anything approaching the end-on position I feel bound to extend this invulnerability to within 500 yards of her adversary. However the question may be argued, it is certain that only a portion of the shot striking the "Monarch" will penetrate, and we cannot suppose this proportion greater than one-half with any certainty. The amount of damage done by the penetration of 5 shot out of 100 fired must be small in any case.

I have now tried to answer the question as to the proportion of shot which might hit a "Monarch" at a mean range, and the other as to the damage likely to be done.

The next question arises from a combination of the two facts evolved from the argument, and it enquires "How much damage will be effected 'upon a 'Monarch' by another in a given time, say six minutes?"

And here I must endeavour to correct the assumed speed of fire by the same data taken to arrive at the percentage of hits.

At the rock off Vigo the speed of the "Hercules" was 17 shot in five minutes from four guns, being 3·4 shot per minute, or ·85 shot per gun per minute. The speed of the "Captain's" fire was 11 shot in five minutes from four guns, being 2·2 shot per minute, or ·55 shot per gun per minute. The speed of the "Monarch's" fire was 12 shot in five minutes, or 2·4 shot per minute, or ·6 shot per gun per minute; the average of the three ships giving ·66 shot per minute per gun. The average speed of the prize firing I have used was ·7 shot per gun per minute. We must take it therefore that this is the maximum speed attainable under the most favourable circumstances. It amounts to one round from each gun in a minute and forty-two seconds, so that I do not think there need be any fear of adopting the one round per gun in three minutes, which is assumed afloat to be the probable speed of "Monarch's" fire in action, as representing the truth. But for my purposes I would rather assume something above the average, and if I allow one round in two minutes, and 10 per cent. of hits, I do not think I place the gun at the range of 1,000 yards in action at all in arrear of its actual place.

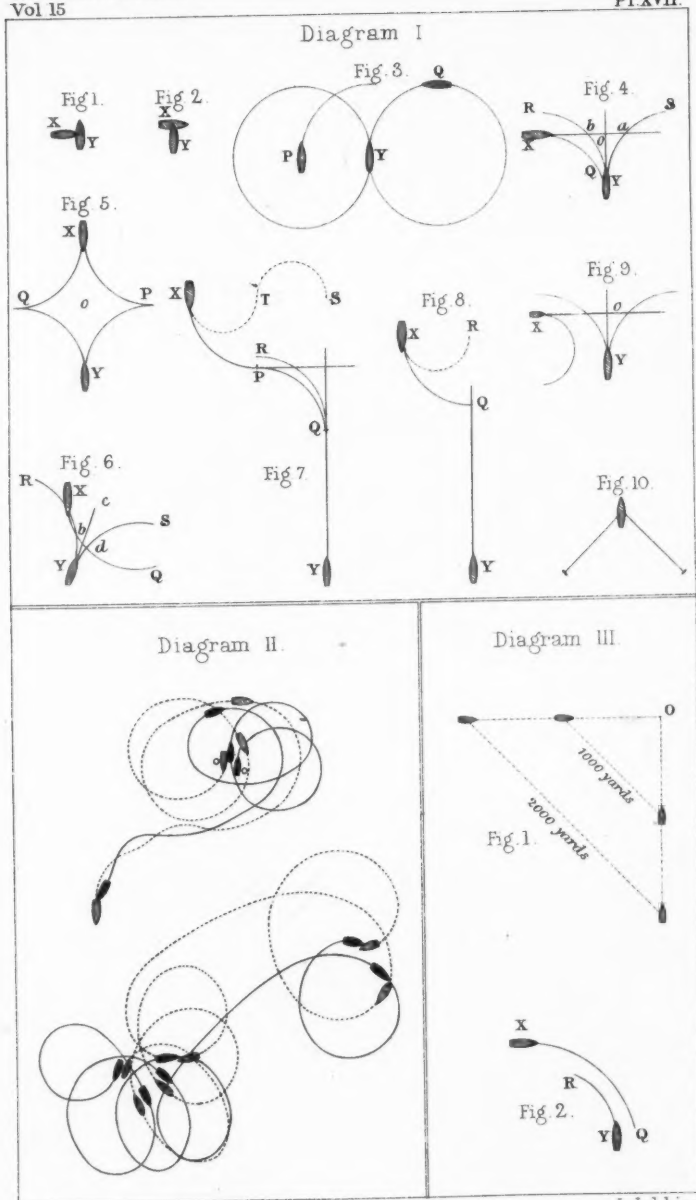
Our summary of the actual gun-power of the "Monarch," therefore, amounts to this.

In six minutes from the opening of her fire on the sister ship at 1,000 yards, she will have fired 12 shot, of which one will have hit and another may have glanced, and it remains an even chance whether the single hit will have penetrated the enemy's armour.

With this extremely curious conclusion to our investigation I shall leave it, and proceed to the newer weapon—the Ram.

Rams.

If we are to consider the question of the attack by rams with any hope of a good result, we must begin at the beginning. We must endeavour to treat the question from a purely abstract point of view. We must take two ideal ships of equal speed and turning powers, and



condemn them to abstain from many methods of defending themselves which both would use in actual warfare. No disturbing causes must enter into our first analysis, but after we have seen how the case stands, when both ships are limited to strict rules in their behaviour, we can ascertain the relative values of those methods which would be used in practice, and we can determine which of them deserve the foremost place.

While, however, we select two abstract ships for our purpose, we must take care they are not impossible types. The relations of the length to the turning powers must be such as existing types fulfil; and the speed over arcs must be such as can be realised: and, as it has been ascertained with regard to existing ships, that at their highest speeds they turn in a circle whose diameter is from four to six times their length, we may take a circle whose diameter is five times the length of our ships as a safe piece of data whereon to found our investigation. The two ships in diagram 1, therefore, are supposed to travel when their helms are hard over, on the arc of a circle whose radius is two and-a-half times their length. We must suppose them for the present unable to reduce their speed, and consequently unable to travel on a curve with a smaller radius; but we allow them to do anything they wish with their helms; and we are to suppose each equally anxious to ram his neighbour and to avoid being himself rammed. For convenience we shall assume the speed of each ship to be 9 knots, and their length to be 100 yards, or 300 feet. The length of each ship in time, that is, the time it will take each ship to pass over her own length with helm amidships, will be 20 seconds; 10 seconds will, therefore represent half each ship's length in time.

It must be now borne in mind that the fact of putting the helm over reduces the speed over the arc in a degree proportional to the amount of helm given. The "Bellerophon," for example, when going 12 knots with helm amidships, reduces her speed to 7·8 knots over her arc; and when going five knots with helm amidships, she reduces her speed to 3·6 knots over her arc. This peculiarity in the action of the helm deserves more consideration than there is now time to give. It is, however, enough for my purposes to state that the fact is so, and that it will affect the question of ramming in the manner to be presently seen. Closer scrutiny of the phenomenon will be found in my former paper on "Modern Naval Tactics."

If now we take two ideal ships under these conditions, represented in diagram 1 as *x* and *y*, we shall observe that so far as *x* is concerned, her object is to obtain the position given in Fig. 1 as regards *y*, and to avoid that given in Fig. 2. *y*, on the other hand, wishes the opposite. She desires to obtain the position given to her in Fig. 2, and to avoid that given in Fig. 1.

What is the difference in these two positions? What constitutes the badness of *y*'s position in Fig. 1, and of *x*'s position in Fig. 2? In both cases these ships are 50 yards too far ahead in space; and ten seconds too far ahead in time. What on the other hand constitutes the goodness of *x*'s position in Fig. 1, and of *y*'s position in Fig. 2? The ships are in both cases 50 yards behind in space, and 10 seconds

behind in point of time. It is clear also that if x were anything between her whole length and half her length *in space*; and between 20 and 10 seconds *in time* behind the position given to her in Fig. 1, she would still strike y a fair ramming blow, for y would not in that time or space be so far ahead as to let x pass astern of her. Again, by as much as x is less than ten seconds in time, or half her length in space, before her position in Fig. 1, by just so much does she run the risk of finding herself in the position given to her in Fig. 2. x 's object is therefore to be between 50 and 100 yards behind in point of space, and between 10 and 20 seconds behind in point of time. Her blow will be just as good if delivered abaft her adversary's beam, as it would be when delivered before it, and if she runs the risk of being too late, she only becomes liable to miss her blow, and does not leave herself open to attack; whereas, if she runs the risk of being too early, she not only misses her blow, but lays herself open to destruction. Even at this early stage of the enquiry, therefore, it is not unimportant to note that if "excess of speed" be capable of substitution for "being too early," and "lack of speed" for "being too late," a ram is not advantaged by the former in the supposed case.

The ship x in Fig. 1, and the ship y in Fig. 2, has gained her object and her complete victory. But before she could have got to that stage, there must have been a time when neither had any advantage over the other. They must have once been outside ramming distance, and free from attack, and therefore on an equality. And they may have entered upon the ramming distance on an equality, which had been converted into an inequality by the superior skill of x in Fig. 1, and of y in Fig. 2. But they may have come into ramming distance on an inequality, and the conqueror may have had it all his own way from the first. Let us, therefore, examine what constitutes ramming distance first, and then what constitutes the inequality.

Every ship when advancing at speed, carries on each side of her two circles of considerable size, within the circumference of which no power on earth can place her. These circles will vary according to the speed at which the ship travels, and according to the power she possesses of stopping herself quickly. Another ship which is anywhere inside this circle, cannot be rammed so long as she remains there. It is clear from this, that it must be from some point within this circle that a ship will find herself able to deliver a blow safe to herself and damaging to her adversary. Outside this circle neither ship can ever get an advantage over the other, both must always be equally free to move. I therefore assume that a ship is within ramming distance of another whenever she is on, or inside, the arc on which the other turns. And, extending this definition to meet cases where neither ship is within the circle of the other, though in close proximity, we may say their ramming distance is twice the radius of the arc described. In diagram 1, Fig. 3, I have represented the ramming distances due to y under the hypothesis we have assumed, and large as these spaces seem, you must remember they are only the average spaces which existing ships carry about with them when steaming. The mere fact of being within

ramming distance of another ship gives no advantage beyond the safety from your opponent's ram. The ship x at p , the centre of y 's port circle has no advantage over y , because y is also at the centre of x 's circle. Nor has x at q any advantage; x is in precisely the same position as regards y , as y is with respect to x . But suppose x to have come into y 's circle as in Fig. 4, and we shall see she has a great advantage. In this case x is *inside* y 's circle, and, therefore, safe herself, while y is *outside* x 's circle, and is therefore open to attack. It seems to me that the whole art and mystery of ramming will be found to consist in this endeavour to get your adversary outside your own circle while you remain inside his.

x has a manifest advantage on the face of matters in this figure. She is excluded from receiving a blow, and is not prevented from giving one. Let us therefore enquire more closely as to the exact chances she has of ramming y under the circumstances postulated.

In the positions given, x is 40 seconds from the collision point o , while y is only 25. If therefore both ships pursue their present courses, x will ram y 75 feet from her stern; y cannot therefore continue her course with safety. Let us suppose she puts her helm hard-a-port, to turn from x along the curve ys . The average time of turning of four ships of the Channel squadron at 12 knots is given as 6 minutes 2 seconds, and at 5 knots, as 10 minutes 45 seconds. We may therefore assume that our ideal ship y will complete her circle in 8 minutes; it will consequently take her 1 minute to turn through four points, which will bring her to a . But x is just 55 seconds from the point a ; and she will, if she goes straight on, be herself rammed by y , 75 feet before her starboard beam. She avoids this mishap by porting her own helm, which has the double effect of delaying her progress, and enabling her to strike y a fair ramming blow before she reaches the point a ; y in short cannot escape either under steady or port helm.

If y puts her helm hard-a-starboard, she has a better chance, for x is only 25 seconds from the point p , while y is a minute from it, and consequently y may get inside x 's circle and be safe, before x is aware of it. But x can only lose his chance from want of skill. It is his sole business to keep inside y 's circle, whatever happens, and he should put his helm hard-a-port immediately, and turn along the arc xq . If y now persists in keeping his helm over, x has only to reverse his own at the right moment, and give y a fair ramming blow amidsthips.

In the case before us, therefore, y does not appear to be able to avoid the stroke of x 's ram by any employment of her helm. If 9 knots is her utmost speed, she cannot now increase it, so escape by that means is cut off. If she had it in her power to reduce her speed *instantaneously* to 5.6 knots, she would only reach the point o at the same time, and therefore on an equality with x . It may be assumed that a ship of any size could not reduce her speed by so much in so short a time; but let me remark, parenthetically, of the difficulty I am placed in for want of data on this subject. It will be clear to you all, that next to a knowledge of the turning powers of ships, and the theory which may be found to lie at the bottom of it, there is no more important consideration for any one proposing to attack by rams, than the time and space

within which the ram can stop herself, or reduce her speed to a given figure. Yet I am not aware that the experiment has been tried with any ship, or that it has been so much as noticed as a requirement.

However the actual case may be, we may reasonably assume that y cannot reduce her speed so as to be 20 seconds later than x in arriving at the point a . But she may hope to escape by reducing her speed, and putting her helm hard-a-port. Let us suppose that she can and does reduce her speed instantaneously to 5 knots. What is the result?

The difference in the diameters of the circles of four ships of the Channel squadron at 12 knots and at 5 knots, was only 53 yards. The radius of y 's arc at 5 knots cannot therefore be assumed to differ from that at 9 knots, by more than a quarter of a ship's length. Hence the arc y now describes will not cross x 's path more than 10 or 12 yards to the right of the point a . This is not enough to save her, in fact it brings x 's blow still nearer the midship point. But besides making this trifling alteration in the matter of space, y 's reduction of speed has made a more considerable one in the matter of time; y will take 20 seconds longer to cross x 's path under port helm at the reduced speed than she did under the full speed of 9 knots. We deduce this fact from the knowledge we have that the average time of four ships of Channel squadron in completing their circles at 5 knots, was 10 minutes 45 seconds, in lieu of the 8 minutes calculated as the time of turning at 9 knots.

Supposing x , therefore, to allow herself to fall into the trap, and to proceed along the line xa at speed, she would cross y 's path entirely, just before the latter reached the point a . But before she got so far as this, she would have surrendered her advantage over y , in having got outside her circle, and allowed y to get inside hers. Admitting she was unskilful enough to do this, y can only deliver a 5-knot blow upon x , and has surrendered so much of her power by reducing her speed to that figure. But we cannot suppose x would lightly surrender her advantage when she can keep it by the use of a little port helm. In this case it is evident that y 's delay along the curve ya , leaves it open to x to give her a perfectly fair ramming blow almost at her leisure.

There is still one last course open to y , namely, to reduce speed with the helm hard-a-starboard; and this seems to me the most judicious thing she can do. She will now take 1 minute and 20 seconds to reach a point ahead of x , somewhat nearer to her than the point b , which latter is, by our hypothesis, 25 seconds only from x . If x therefore delays an instant in putting her helm hard-a-port, her circle will pass ahead of y , and she may find herself open to the blow of y 's ram at the reduced speed, or, if she saves herself from the danger, there may not be room for her to give y a stem blow. The two ships will, in short, most probably rub broadside to broadside in passing, without material damage to either.

But it must not be supposed because y does the best thing possible under the circumstances that she gains any advantage over x ; she may recover the position of equality she originally lost, if x is unskilful enough to permit it, but that is all which is left open to her, and in any case her

reduction of speed is a surrender of her manœuvring power directly in favour of x 's proceedings. It is open to x to reduce her speed at the same time y reduces hers, in which case she retains all her former advantages, except that her blow, if delivered, will not be so heavy.

I have not time on the present occasion to pursue the enquiry as to whether the position I have assigned to my two ships in Fig. 4, is really the worst for y and the best for x ; it is sufficient for my purpose to show that it is a position extremely desirable for x to seek and for y to avoid, and that if y unhappily allows herself to get into it her fate is very nearly sealed. I think, however, the general principle may be assumed that the grand object of an attack and defence by rams must be to keep your adversary outside your circle, and at the same time to keep within his.

The next point we have to consider is how should x approach y so as to get into the desirable position?

There is a very prevalent idea afloat that the end-on position is the one proper to be assumed. It was one held by myself also, I may say, until I undertook the preparation of this paper, and I can, therefore, the more freely deal with it, and, if necessary, condemn it.

Let us suppose, then, that x and y , meeting in the open sea, and being each imbued with the necessity of keeping the end-on position, steer for each other. They must either give up their end-on theory, or they will at length reach the position given in Fig. 5. They are now within ramming distance, on an equality certainly, but each precluded from using the weapon that each is endeavouring to use, unless they are willing to try which is the hardest at the point o , an extremely improbable conjecture. But observe the position they have placed themselves in. They must either stop where they are, and give up all hopes of ramming, or they must dash at each other on an equality, or one of them must try some other plan. What plan is open to her, let us say, to y ? She may turn along the curve yp , or along the curve yq , or along any curve between those.

Let us suppose she puts her helm hard-a-port; in 30 seconds the ships will be in the position given at Fig. 6. In this position y has turned through two points, and is just about surrendering her equality, and allowing x to come within her circle, while she herself is outside x 's circle. The danger of her manœuvre is not so great as it at first appears, but there is no doubt that she has surrendered all hopes of using her ram upon x .

That she is not actually in danger may be noted from considering that she is 30 seconds from the point d , while x is one minute from it; y , therefore, has a good chance of dragging her whole length across x 's arc before she reaches the point d . But y has a still better chance of escape if she now rights her helm, for she is only 20 seconds from the point b , while x is 53 seconds from it. But, whatever her chances of escape may be, she has no chance of attack, and, as it may be assumed that any movement either ship might make from the position given in Fig. 5, would result in a position similar to that in Fig. 6, we must take it that there is a fundamental error in the end-on approach of two ships intending to ram.

It may be true that the end-on position is proper to avoid being rammed when there is no intention of ramming, but this is not the case we are now called on to investigate, and is assuredly not the case supposed by those who have abrogated the flank method of evolution in favour of the oblique.

Let it be noted here that though from a consideration of Figs. 5 and 6, there is great objection to the end-on position when *within ramming distance*, there is no objection to it beyond ramming distance; but then, on the other hand, neither is there any objection to the broadside position, or, in short, to any other position. The question of the nature of an evolution does not seem, therefore, to be affected at all by the proposal to attack by rams, although the nature of a formation may be. The only movement undertaken when within ramming distance would be the final sweep to ram, or avoid being rammed. Any preparation for this final sweep must be made beyond ramming distance, where the ships are free to use what means they please.

As this end-on approach is not to be sought for in a ramming attack, because of its liability to result in a position given at Fig. 5, the question is how should two ships approach each other who are equally ready for the combat?

The answer is to be found by considering that the only difference between x and y in Fig. 4, is that x is half a ship's length further from the collision point o than y is. We must expect the struggle to be to keep the courses at right angles to each other, but to be rather behind in reaching the point where they cross. The two ships may, therefore, steer for each other in the first instance, but before they close they will each mutually assist to place their courses at right angles, and to keep them so, or one of them by superior skill will approach on something near the end-on position until he can by a sudden and unexpected movement bring himself within ramming distance, at right angles to the other's course, and inside his circle at the same time.

In the first case, each ship would immediately bring the other, four points on the bow, and so gradually approach each other, and the most skilful of the two would by such means as were open to him take care to be a little behind at the last moment, ultimately taking the place of x in Fig. 4.

In the other case the ships would steer directly for each other at first, and might be expected to assume parallel courses, at such distance as would be determined by the most skilful of the two, and we should thus ultimately find them in a position similar to that given in Fig. 7. Here x has determined to get into the position p , by a turn of eight points to port, at the same time as y , by pursuing his course, arrives at the point q . x is 2 minutes from the point p , consequently his turn must be made when y is 2 minutes, or 600 yards, from q . The distance between the paths of x and y must be equal to the diameter of the circles, or else x cannot come into position at p . x will consequently commence proceedings when y is at the great distance of 1,200 yards from him, and nearly $2\frac{1}{2}$ points on her bow.

If all goes well, and y permits herself to fall into the trap, x will certainly gain her wishes and destroy or damage y , being herself in

perfect safety; and there is certainly this to be said for such a method of attack, namely, that y will only observe the bearing of x to alter a couple of points, will have little guide as to her intentions, and only two minutes in which to make up her mind. Yet, of course, any movement of y 's helm either way, before she reaches the point q , will overthrow x 's calculations, and make it necessary to try some other plan. y , however, may divine x 's idea, and may, by slight alterations of course to port, bring herself within x 's circle when she gets abreast of the point q . She will thus turn the tables upon x , which is just the risk she runs, and which may arise from a miscalculation of the distance or speed of y . The point to notice is, that this method of approach on parallel courses, a diameter apart, is one which may be adopted by two ships equally anxious to try their skill against each other in ramming.

We should notice that x , in adopting the foregoing method of approach, proposes to obtain her object by a double movement: one into the safety position inside y 's circle, and the other the delivery from thence of her final blow, and she leaves it in her power to abandon her intention at any moment prior to reaching the point p . Having once reached it, she places herself in the power of y if she turns out to be a certain distance to the left of q .

But x may also decide to deliver her attack from the outside of y 's circle, and only to come within it at the moment of collision. In this case, she will approach on a course parallel to that of y , but only one radius distant from it, as shown in Fig. 8. Here x must put her helm over when y is $1\frac{1}{2}$ points on the bow, and about 850 yards off, and she will arrive at the point q a little after y reaches it, supposing the latter to steer a straight course. But it is most unlikely that y will put herself into the wished-for position. The change of helm by x , will be very apparent to y , and her design almost equally so, and the smallest possible movement of helm may not only baulk it, but place x in a very difficult position, for it is possible that y might meet x within ramming distance, while the latter had her helm hard over, and the former had her's amidships. In this case, x would clearly have only half the manœuvring power of y , and might suffer for it. x in short cannot make a re-calculation of her position and prospects when within ramming distance, should she attack in the method given in Fig. 8, while she can well do so should she attack as in Fig. 7, and should she choose the first method of approach, bringing her enemy rather less than four points on her bow, *and forcing her to keep so*, she is perpetually re-calculating her chances and position.

We have now discussed roughly the principles of an attack by rams from ahead, when the ships have equal speed and turning powers, and I think it is apparent that the 4-point method of approach is the one we should choose under the circumstances.

We may now look into the advantage, if any, which x would gain from the possession of superior speed. We may in doing so, leave out of the question those advantages which speed gives in bringing the enemy to action against his will, for we are supposing both ships equally anxious to meet. We need not, therefore, trouble ourselves

except with the changes which greater speed for x would introduce in her position in Figs. 4, 7, and 8. In Fig. 4, if x had a speed of 12 knots in lieu of 9, she would, by pursuing a straight course, strike y nearly amidships at the point o , instead of well abaft her beam, she might therefore begin her attack from a position farther astern, and therefore safer from a miscalculation of the size of y 's circle. This would be her advantage also in case y put his helm a-port. But on the other hand, if she found herself at the position given, with this extra speed upon her, she may be obliged to forego her attempted attack in order to save herself, for if y puts his helm hard-a-starboard, x is advancing so rapidly that she can hardly avoid allowing y to get inside her circle, and the moment that happens, she is either at y 's mercy, or she must escape under starboard helm and her superior speed.

In Figs. 7 and 8, the advantage of superior speed is that x may allow y to approach more closely, and therefore under a better estimate of her distance before she turns: there is no other advantage known to me.

Reverting then to Fig. 4, if x with greater speed than y means to attack her with the same advantages as x is now seen to possess in the diagram, she must either be further from the point o herself, or y must be nearer to it; but the skill required at the low speed and at the high speed is equal, and the dangers of being rammed instead of ramming, are possibly a little increased. I do not look upon great speed consequently as very important for a ram.

But if the question is not one of permanent speed, but of the power of increasing or reducing the speed of the ships rapidly, then there can be no question of the advantage. The increased speed will save the ship from being herself rammed, and the power of reducing it will enable her to ram effectively, and hence we may assume that a very heavy ship is an inefficient ram, for she cannot have the same powers of varying her speed as a much lighter one would have.

But now, suppose x with no advantage in speed, is half the length of y with the same proportionate turning powers, and observe the conditions under which she will meet y in Fig. 9. It may be seen at a glance that she has y absolutely in her power, for she has all the advantages she before possessed, besides the infinite advantage of manœuvring freely within y 's circle, and being able to frustrate in the most perfect manner any attempt of y 's to escape under starboard helm, which we before saw was really her only chance.

Then again, look at Figs. 7 and 8 as to her facilities for attack under the new conditions. In Fig. 7, if x had miscalculated her distance and found y would be too far ahead to be rammed from the point p , her stroke was altogether lost, but under the new conditions she may commence on the curve $x p$, but end on the curve $x t$, thereby having it in her power to move the point p to suit the movements of y . While under the old conditions, the boundary of her possible movement under starboard and port helm was $x p q$, it is now enlarged to $x t s$. So in Fig. 8, x may commence on the curve $x q$, but has a reserve of manœuvring power as far as $x r$.

If it be said that y by increased speed can make up for x 's increased turning powers, I think we must deny it, unless y surrenders all idea of ramming, or even of allowing her adversary to come within ramming distance. If she allows x to close her, and to get into the position given at Fig. 9—which she is very likely to do—her speed will hardly save her; for allow her 12 knots to x 's 9 in Fig. 9, and she cannot escape under starboard helm, she has not a foot to spare under port helm, and she has not a ship's length to spare under steady helm; and it is not to be supposed that x in the confidence of her manœuvring power, will not provide against this chance, by keeping much closer to the point o .

There is, however, a method of attack for which superior speed is necessary to success, and that is the attack from the rear, either directly or by an advance past the adversary, and a turn upon her. Of the direct attack I need not speak much; it would doubtless be possible for a ship with superior speed to chase and to ram a ship of inferior speed, which declined to face her. But the blow so given would be a light one, as its velocity would only be the difference between the two speeds, and it would undoubtedly be long in coming. The indirect attack is made by the ship with superior speed coming up from the rear on a course parallel to her adversary's, and one radius distant, then drawing sufficiently ahead to strike her at right angles by a turn of 8 points. This case is ably treated by Admiral Boutakov, and I agree with the conclusion he draws, that the adversary need never allow herself to be so rammed; she can see the opponent gaining on her, and must know what the result will be; she can then either turn from her or towards her in perfect safety, and the result will ultimately be the direct attack I have noticed.

Long as we have dwelt upon this question of the ram as a weapon, it must be apparent to all that I have only touched the outskirts of the question, and until Naval Officers will turn their intelligence fully upon it, on the outskirts of the question we shall remain.

We have, however, I think, shown a probability that the following conclusions approach the truth:—

1. The end-on position must never be taken up by a ram until the moment her spur strikes the object.

2. Extreme speed is not so necessary for a ram as extreme powers of turning.

3. Great length and weight are an inconvenience to a ram. It may be added that they are not necessary for an effective blow. The work done upon a ship by the 400 lb. shot from the 18-ton gun is under 5,000 foot tons. The work done by the stem of a vessel weighing 1,000 tons, propelled at 10 knots, is equal on impact to 4,270 foot tons, and the work is done below the armour.

4. So far from ramming being a difficult or impossible task, it is a thing which can be accomplished by superior skill with vessels otherwise equal. But a ram whose turning powers are much greater than her adversary's, may attack her with every confidence of success.

This seems the place to advert to the ordnance proper to be carried by a ram.

I must confess myself doubtful about the end-on fire—a result I did not at all expect to arrive at when I planned the paper. I had in my previous papers laid it down that I would in no case use my guns on approaching to ram, but that I should be glad to see my adversary use his, because my movements would be disguised thereby, and I observe a great French authority, Admiral Jurien de la Gravière, has recently advocated the same view. If this is so, when *is* a ram to use her artillery? The answer seems to be, when she has missed her blow, and is passing her adversary broadside to broadside. Except at that moment, “The poor advantage,” as Admiral de la Gravière says, “to be gained by a discharge rendered uncertain by the rapidity with which the distance varies, cannot compensate for the cloud of smoke which would envelope the ship at the all-important moment, when her safety depends on the precision with which she is handled.”

It may be argued that this is true enough of the case when within ramming distance, but that ships should be armed for end-on fire before coming within it. The answer to this is, that we have seen how a ship may really commence her ramming manoeuvre at the distance of 1,200 yards if she approaches the end-on position, and that if she approaches on a 4-point bearing, a very slight alteration of course, will bring her broadside guns to her.

I thus conclude the rough examination of the ram question as applied to single ships, and as separated from artillery fire and the torpedo. I must now pass to the latter and newer weapon.

Torpedoes.

In the very admirable paper given to us by Captain Dawson, on Offensive Torpedo Warfare, he expressed his conviction that we were neglecting a very powerful and valuable weapon in the outrigger torpedo, which he believed applicable to fleets. Unfortunately experiments on the question are wanting, and it would not be possible, in the absence of them, to make the outrigger torpedo a basis of attack and defence. This much may be said for them, however, that if they succeed at all, they will certainly succeed in an attack from the rear. I have shown that a vessel with superior speed may strike another about the stern with an inefficient blow, equal to the difference between their speeds. These are the conditions under which the outrigger torpedo would supply the deficiency. The vessel using it, consequently wants speed, but need not be a ram. Captain Dawson thinks they might be employed in outriggers at right angles to the keel, and be so used by a ram which had missed her blow and was passing broadside to broadside of her object. Under such circumstances the torpedo would compete with the broadside gun, and I am rather inclined to think the latter to be the more effective weapon.

The Harvey torpedo seems to me a weapon by itself, and not an auxiliary, like the outrigger torpedo. I understand that Captain Harvey deprecates its use in ordinary ships, and proposes special ships, to employ no other weapons. To me, however, it seems a weapon well adapted as a defence against rams in large and long ships. If the ship

y in Fig. 9 was known to be towing a torpedo on her port quarter, as in Fig. 10, it enormously increases the hazard of *x*'s attack, although it need not deter her altogether. Her tactics would be, in the event of missing her blow, to pass close under the stern of *y*, trusting to run over the torpedo line. The danger, however, would be great, for the line might easily be fouled, and then *y*'s progress might draw it under *x*'s bottom and explode it there.

The Harvey torpedo vessel does not require anything but great speed, but this she must have to be efficient. The tactics she pursues are very much simpler than those of the ram, for she does not want to be in a particular place at a particular time; all she requires is to pass her adversary within about 200 yards on any course, and her mission is fulfilled if she succeeds in doing so. In the attack by such a vessel on another of her class, skill appears useless as against speed, and it would seem the slowest ship must be destroyed. The object would probably be an endeavour to cross each other's bows, and the fastest ships must ultimately do this.

These few remarks are all which seem to me necessary on the question of torpedoes as applied to the attack and defence of single ships. They are weapons destined to play an enormous part in the operations of future naval war, and if hereafter I continue this subject, their immediate part in fleets must be examined, but as regards the chief of them, the Harvey torpedo, I don't see how it can be discussed by itself. A Harvey torpedo ship meeting another in the open sea, and knowing her to be one, cannot run down upon her and trust to chance as to which torpedo takes effect first. She may certainly approach as a ram (*x*) would in Figs. 7 and 8, with the intention of crossing *y*'s bows at some distance; yet *y* can never be supposed foolish enough to run such a risk. If she thinks she has superior speed, she will carefully abstain from all close quarters except with her head the same way as her enemy, and with helm amidships. It is not as in ramming, where a distance of 50 yards or so makes all the difference between victory and defeat. It is more a question of superior speed, and a knowledge that the superior speed, properly used, *must* destroy the adversary by torpedo, just as superior turning powers must destroy her by ramming.

The effort of two torpedo ships, it seems to me, will be confined to ascertaining which has superior speed, and the strong probability is that in the ascertainment of that fact one of the two will perish.

The Attack and Defence of Single Ships.

Only now, after this separate treatment of the gun, the ram, and the torpedo, are we in a condition to combine them, and to observe the effect under such circumstances. But before proceeding to such combination, it appears to be the proper moment to advert to foreign naval opinion on the status of the weapons. I must leave the torpedo out of this account, for I know not the opinion entertained about it abroad.

The rise of the ram in foreign estimation is one of the most re-

markable features of the age. Dating from the first utterances of our gallant Admiral of the Fleet, Sir George Sartorius, the ram has carried all navies by storm, and, so far as I can gather, except in Russia, without enquiry. When I read my paper on Modern Naval Tactics here, in the year 1865, and acknowledged myself a complete convert to Sir George Sartorius's views, English naval opinion was incredulous. Admiral Boutakov had written ably on naval tactics, but had nowhere expressed a conviction that the ram governed the tactics of the future, although an enquirer so acute and unprejudiced could not avoid allusion to its growing importance. In France, a system of tactics based wholly on the supposed unrivalled empire of the gun existed, and there was only the faintest glimmer of an idea that the old line of battle was about to fall from its high estate.

Now look at the change. Admiral Boutakov has worked at the ram question to an extent unattempted by us; and Russia has drawn up her scheme of naval evolutions on the avowed principle that the ram is the only weapon of value against a fleet. France has pushed her old system of evolutions into the back ground, in the firm belief that the ram, and the ram only, need be feared at sea.

The ramming experiments tried by the Russians under Admiral Boutakov, are altogether too interesting to be left without a passing notice. He took two gunboats of 200 tons each, and fitted them up as harmless rams. A sort of gabion or extra large fascine was fitted to the stems of these craft, and a belt of fascine work ran all round their gunwales. Captains of two of the ships present were placed in respective command of the rams; they were turned broadside to broadside, head and stern, and started to damage each other as much as they could. Cross-bearings of the two rams were constantly taken during the continuance of the struggle, and the corresponding tracks mapped out. Two of these encounters have been reproduced in diagram II, where the dotted line represents the track of the ram "Priliv," commanded first by Captain Kolong, and secondly by Captain Vogak. It was a rule in these encounters that a Captain lost his command when he was rammed, and consequently some Captains of greater skill slew several foes before they lost their own command. The struggle represented in the upper figure lasted 16 minutes, and the track of the victorious ram, the "Goul," commanded by Captain Ivanov, is shown in black. Ivanov was again victorious in the struggle shown below, but not till 30 minutes had elapsed. Twenty-one of these encounters are given in the pages of the "*Revue Maritime*," and the shortest time in which the ramming was effected was 5 minutes; the longest being 50 minutes; the average being just 20 minutes.

No doubt the battle of Lissa has had much to say to the advance of the ram question, but in England we did not lay that lesson to heart as Russia and France have done. The confirmation of my belief in the ram which Lissa gave, and which I very strongly put forward, carried only a small section of the service with me. I was still met as before, by the remark that it was very difficult to ram another ship, and I believe that even now only a section of the English Navy is disposed to forsake the trust in our guns and to put it in our stems.

If I am not completely in error on the question, I hope that what I have already said to-night will lead my brother Officers to look into the matter more closely than they have yet done, and with minds so much more capable than mine, to ascertain what the truth may be, and not to rest satisfied with mere vague phrases and vaguer thoughts.

Let me now briefly endeavour to picture what the nature of a duel in the open sea would be between two "Monarchs," each equally ready for the fray, but one of them determining to use her guns and depending upon them, and the other looking at her guns as a secondary weapon. To keep up our terminology, I shall call x the ramming ship and y the one depending on her guns. x would, on first sighting her adversary, bring her about 4 points on the bow and manœuvre so as to keep her there, while she advanced at speed. y might be expected to steer direct for her enemy, trying perhaps an occasional long shot and swerving slightly to do it. At about 2,000 yards distance, y would find it convenient, if not forced to do it before, to bring x about 4 points on her bow so as to keep a steady fire upon her, which we must suppose from that moment to commence. They are each now, in Fig. 1, diagram III, 1,400 yards from the point at which their courses cross; and if they were going 10 knots,—which x at least will be certainly doing, as she knows her greatest safety from shot lies in the rapid alteration of elevation of y 's guns,—if they were each going 10 knots, they are only 4 minutes 12 seconds from collision. What damage can y do with his shot in that time? She may fire two shots from each gun, or eight in all, of which we have seen *none* would hit if the ship was steady at 1,000 yards; and the distances at which these shot are fired varies from 2,000 yards to nothing. The gauntlet which x runs is a bagatelle, no ship need fear it, and if y has laid herself open, and permits x to get into ramming distance, as in Fig. 4, diagram I, it is all over with her, unless she has reserved her fire for the supreme moment. But we may be quite certain that no fire will be reserved. She will have exhausted all her efforts in combined accuracy and rapidity, and x will only run the chance at close quarters of receiving a stray shot badly aimed, as it is sure to be at such a time. If x has passed through 4 shots, a minute before collision, she is safe from any further fire.

But suppose that y is wise enough to perceive his danger, and to turn towards x , along the curve $y r$, Fig. 2; x cannot now ram conveniently, he therefore takes the step he had previously prepared for, and brings his guns into play. His method is to sweep round upon the large circle $x q$, with his guns trained right abeam on the starboard side. In 30 seconds he discharges them full into the plates of y at pistol range, and passes away unharmed to prepare a renewed encounter.

I cannot pass a very probable feature of this kind in a naval duel, without remarking on the advantage y would have were she armed as a broadside ship. If y discharges her port broadside at x , two minutes must elapse before she does it again; more than two minutes must elapse before she can transfer her fire to the opposite broadside; consequently x has it all her own way in passing starboard side to star-

board side. If y , however, had a second set of guns ready on her starboard side, x might take less from her manoeuvre.

Time does not permit me to dwell longer on a part of my subject which will bear any amount of the closest study. I have indicated what seemed to me the absolute values of the gun and the ram, and I have endeavoured, by bringing them into opposition in a fight between two ships, which I imagine to be a representative combat of its kind, to get at their relative values. I might infinitely vary the circumstances of approach and subsequent conduct, but so long as x acts on the assumed superiority of his ram, and y on the assumed superiority of his guns, their combat must partake of the nature of that I have sketched out. x will again and again make his effort to ram, and will only take to his guns after each failure; y will persist in believing he is damaging his opponent, which in my view he will not do, and x 's failures to ram will not prevent him damaging his opponent effectually by his broadside guns.

There are some points to be noticed in the details of such a combat, as I have sketched. x cannot be put to a disadvantage by the direction of the wind, whereas, if y is unhappy enough to engage to windward, the smoke from his own guns will hide x from him, and will, while it interferes with his own fire, effectually shield the operations of x from view. y , however, is not at all hidden from x , who observes her every movement at his leisure.

The temptation to go at slow speed so as to make better shooting, is very great; yet nothing could be more dangerous than to be caught at slow speed within ramming distance by a ram.

It may be thought that it is improbable that all combats should take the form I have sketched out, but I think it is possible, that if one ship determines to keep her opponent on a 4-point bearing, she compels her to do the same, as being the only way of approaching, so that the ram is still the master, even in directing the method of his enemy's approach.

Wherever the Harvey torpedo makes its appearance, whether in company with guns and rams, or by itself, it is still speed which must carry the day. Whatever one ship may think of his guns or his ram, he must try his speed and his torpedo, if the other chooses to adopt that mode of attack. y could not, as in Fig. 2, diagram III, if x was towing a torpedo, turn towards him and allow him to cross his bows: he must turn away from him, and trust to his own torpedo to keep x 's ram clear of him. Hence they come to parallel courses, and artillery fire, broadside to broadside. The struggle will immediately be, which is to head the other, and whichever can succeed, must be victorious. The tendency of the Harvey torpedo seems thus to be, to bring the gun forward again, as the tendency of the ram has been to push it back. While this struggle for precedence continues between two torpedo vessels at short range, much damage must be done by artillery; and if the speed of the ships is nearly equal, the combat might be decided by a broadside action of the old type, except, that it is carried on at high speed.

Here then, I close, my examination of the bases on which the attack,

and defence of modern fleets must rest, and no one can be more conscious than I of its vagueness and imperfection; but I hope it will be admitted, that I could not proceed to carry out the examination set forth in my title, until I had come to some conclusions, such as I have put forward: and, in any case, I trust to have shown, that with proper experiments and deductions therefrom, the relative importance of the weapons we are dealing with, and their judicious employment, first, in single ships, and finally, in fleets, may be fairly estimated.

I must not quit the subject without adverting to those principles of construction and armament, which the matters we have been discussing, appear to recommend.

End-on fire appears less a desideratum than I at first supposed it would turn out. For a ram it seems quite unnecessary, as the latter seems to combine much more satisfactorily with the old-fashioned broad-side gun.

The ram, pure and simple, is strongly advocated as a weapon, by Sir George Sartorius; and I must own that, it seems to me, a gunless ram of equal speed with the "Monarch," but about one-fifth her size, would meet her on equal terms in the open sea.

If such a ram were to attack, a larger ship could best defend herself by a large number of light shell guns. Such might be easily employed in a broadside ship, in addition to her plate-piercing armament, but could not be employed in the "Monarch." If, however, it is found that a ram of 1,000 tons can be so plated as to resist all but the heaviest shot when striking at an angle of 45°, then it appears to me, there is no help for the larger and more unwieldy mass such as the "Monarch," except the towing torpedo.

If light swift torpedo vessels are designed, a heavier and slower ship must meet their attacks by multiplying the numbers of lighter guns carried.

On the whole, it does appear to me a matter for very serious consideration, whether this struggle after guns which will pierce the heaviest plates at long range, has not overshot itself—whether the point has not already been passed at which the reduction in the number of shot, which can be fired per minute, is compensated by the increased power of the gun.

But while it is impossible to dogmatise on these various points, am I wrong in thinking that the service and the country, should seriously undertake to determine the relative values of the gun, the ram, and the torpedo, and not to rest content for one moment longer in an atmosphere of misty ideas on the question?

The CHAIRMAN: If any gentleman has any question to ask, or any remark to make, I am sure Captain Colomb will be glad to reply to him.

Captain DAWSON, R.N.: When Captain Colomb read a very interesting paper, four years ago, on a similar subject, I went away very painfully struck with the fact, that there were so few experienced Officers present who attempted to grapple with the subject brought before them, and to give us the benefit of their experience. I hope that we shall not have the same complaint to make this evening. I did not quite agree in all respects with what fell the other evening on the subject of "naval education" from a brother Officer, that Naval Officers

are altogether deficient in the logical or reasoning faculty. If that idea be still held by my friend, I think that to-night he must have been disabused of it very much indeed, for Captain Colomb has shown that he has not lost his reasoning powers during his recent service afloat. Confining myself to the general subject, I will not enter into the details of this paper, which we cannot do off-hand. There has been no real fighting in earnest at sea since the days of our grandfathers. There has been none in connection with our own Navy; and there has been very little in connection with foreign navies. There has been no real out-and-out fighting like that of the old sea-days, except, perhaps, a little the Americans had in their recent civil war. So that the conduct of a modern sea-fight is entirely a hypothetical subject, which one can only speculate upon as an interesting problem, full of unknown quantities. As an old gunnery Officer, I long ago came to the conclusion that steam was against the gunners, fatal to the guns, fatal to accuracy of fire, because of the fatal facility with which the helm can be used simply to manœuvre, without reference to the guns and gunners. I have often felt, as a gunnery Officer, that the days of guns as a truly offensive weapon were numbered. If we went into action now with other navies, that are equally skillful and equally courageous as our own, and equally ready to join in action, the first attempt, I think, on both sides would necessarily be to use the guns. But when we are told, as I understand from the paper, that the "Monarch," can only make one hit every four minutes, so that in the course of forty minutes she would only make ten hits at various angles, with hardly any penetrations; patience on both sides would soon be exhausted under that process, and both would necessarily be driven to ram. If that is the case, then, every ship, large and small, ought to be fortified and strengthened in the bows for the purpose of ramming, should the opportunity arise. I have always thought that there would be very great difficulty in ramming at a vital angle; but, as the lecturer went on, he shook my ideas of the difficulty of a ram striking another vessel, though I still think experience and skill and nerve would alone accomplish it. What shook me most was the account of the experiments so practically conducted by the Russians, under the guidance of the first seaman of the day, Admiral Boutsakov, in which it appeared that striking with the ram was a certainty. It appears, then, to be an established fact that one of the vessels can ram the other at the end of a certain number of minutes. That fact has shaken my scepticism as to ramming. But if those Russian vessels had not only acted as rams, but had been provided with guns, and also with torpedoes, they would not have passed one another so frequently in the effort to ram without inflicting injury with their guns, or without bringing their torpedoes into destructive contact with one another. That brings me to another point. If the torpedo were to come into use in conjunction in the same ship with the ram and with the guns, it would restrain the indiscriminate use of the ram; for just as the ram supplants the gun, so the torpedo will supplant the ram, as it would be difficult and dangerous to approach a vessel for the purpose of ramming, which was bristling with torpedoes all round. The gun would then come into requisition to protect both the ram and the torpedo. The conclusion I come to is, not to build special vessels for any one arm, but that every ship should be armed with all three weapons, to be used as opportunity offers. These are the changes which are coming in future combats, and they must be met by corresponding changes in our ships. I understand that Sir George Sartorius, whose opinion we should all defer to, thinks he can avoid the torpedo when he is ramming; but I should not like to come into close quarters with a vessel that was bristling all round with torpedoes. That is a point upon which I should be glad to hear the opinion of the Officers present, who are better qualified than myself to give an opinion.

Commander A. H. GILMORE, R.N.: I came here prepared to hear a lecture on manœuvring fleets, and Captain Colomb has given us a lecture on a trial of skill between two rival Captains in command of rams instead. I suppose they are to be either broadside ships or turret ships. I think in the case of ramming, the turret ship has a great advantage over the broadside ship. She has merely to be kept end-on, and she has the use of her end-on fire, to which the other vessel must expose her broadside before she can reply. I was with Captain Dawson some years ago, at the first trial of Captain Harvey's torpedo. No vessel would attempt to ram another that had the use of these torpedoes, unless she was fitted up on the cellular system.

No doubt those Russian officers, when trying to ram one another with gunboats, were under no idea of coming to any great grief. Their nerves were quite steady; they had merely to get their stem on one another's vessel if they could, and, protected as these experimental gunboats were, without danger. But, as Captain Colomb says, a few seconds here, a few seconds there, in calculating the time, a turn ahead of the screw more or less, must make it almost impossible for vessels to meet at an effective ramming angle. Then I think the power of the gun must have a great influence upon the vessel being attacked. For instance, *x* means to ram *y*. *x* being unarmed, merely a ram, *y*, bringing the whole force of her artillery to work, must do a great deal of damage to *x*. I think also the present system of guns will bear no comparison with Captain Harvey's torpedoes. I know no Officer in command of a ship that dare approach a torpedo vessel. All you want is a small vessel of high speed, belted round the water line, and decked over, as the Irish dispatch vessels are, with a rise in her deck, and the shot would glance off. She is perfectly impregnable to the heaviest shot of any gun, and would herself destroy an enemy with perfect ease.

Captain GOODENOUGH, R.N.: I think Captain Colomb, in his very suggestive paper, has given the very best plea that could be given for the intense study of these subjects. For, as it has been said that boldness, and nothing but boldness, will carry the day in war, so I think you can say that nothing but intelligent study of our profession in time of peace will prepare us for the development of that boldness at the proper time. In no case is that more strongly shown than in this system of attacks by ram, where boldness will be the necessary accompaniment of intelligence. Because, after all, you may conceive a number of imaginary positions of ships, and imaginary forces and speeds of ships, and you may draw a number of combinations of those ships' movements upon paper, and yet at last the ramming blow will be struck by the boldness and stomach of the Commander of one of them. I was very much struck with what was said by Captain Vansittart when he was in the Channel Squadron. Being asked his opinion on ramming, he said, the first thing necessary in an Officer who was going to ram was that he should have a good stomach and a good digestion. There cannot be any doubt about it; because in every case in which the ships are brought together, if they are ships of equal speed and equal turning powers, an excess of correctness of eye, of judgment, and boldness on the part of one man will in an instant decide the engagement. There are one or two points in the lecture to which I should like to advert. The first is on the general remarks which preceded Captain Colomb's lecture. He draws attention to the necessity of opinions being formed on this subject, in order that our ships might hereafter be properly designed. There can be no question as to the very great necessity of this. There was one thing said with regard to guns which I think Captain Colomb might correct a little. It is the experiment in Vigo Bay. His deduction from that experiment has been most careful, and he has rather overstated than understated the power of the gun; but in one place he stated that the number of the rounds fired from the 25-ton gun was one in two minutes; in another place, that it was one in three minutes. The Vigo experiment was this—that with the guns of each ship all loaded, a signal was made to commence firing at a large rock. Therefore, the guns were fired at the very instant the signal was given to "commence." The result was that the "Hercules" fired about four rounds per gun in five minutes; the "Monarch" and the "Captain" fired about three rounds per gun. Therefore, in estimating the number of rounds, you should subtract one round, or once the number of guns, in making the calculation. It would, therefore, appear that the guns were not fired so rapidly as Captain Colomb has said. That would make a difference in favour of his argument. Then, we come to the comparison of the "Monarch" and the "Hercules," a comparison which has been followed out still further in the general observations as to the turret and the broadside ship. I am not sure whether Captain Colomb wished to state the question in this way, and I would ask him in his reply to put it more clearly, whether he would consider the "Monarch" as a broadside ship carrying her guns in turrets, or whether he considers the "Monarch" as a vessel apart from the "Hercules," as a true turret ship. Because that is what the "Monarch" seems to me to be. There is no reason, for instance, why, under the forecastle of the "Monarch," we should not put guns (sup-

posing she had now a fore-castle big enough to carry them), of equal power with the guns under the fore-castle of the "Hercules." Therefore, it seems to me, it would be more distinct and more definite, and it would lead to more scientific argument, if the "Monarch" was to be defined as a broadside ship carrying her guns in turrets, leaving the appellation of "turret ship," or some other definition, to express clearly a vessel that has a fire from her heaviest guns all round, in line of keel, ahead, all round on either side, and very nearly in line of keel astern. In that case I am doubtful whether Captain Colomb would still stick to the broadside ship, pure and simple, or the broadside ship carrying her guns in turrets, when the former has so limited an arc of fire as 70° , viz., 35° before and 35° abaft the beam. Passing now from the guns to the diagrams, and to the part of the lecture which deals with ramming, and which Captain Colomb has so clearly set forth, I think he enters upon the argument with an admirable proposition, namely, that a ship advancing at speed has two circles on either side of her, within which she cannot possibly place herself. That is an expression which gives a very concise view of the state of affairs. Going now to Figs. 4, 5, and 6, the very arguments which he has used, and the diagram which he has drawn, lead me, contrary to his opinion, to have a very strong feeling in favour of end-on fire, which I would not limit to a fire simply in line of keel, but which I should describe as a fire uninterrupted in line of keel from some points on one side of the bow to some points on the other side of the bow. If the fire was simply end-on in line of keel, with very few degrees on either side, I think it would be very inoperative, and not worth the price which you must pay for it. But the fire round the bow is to me of the greatest value, because, looking at Fig. 4, it seems to me that the very great advantage which x has there—it has been well pointed out by Captain Colomb—is, that y is more nearly in the line of x 's keel than x is in the line of y 's keel; and that whenever x quits that position and turns away from y , she at once gives y the position of advantage which Captain Colomb has pointed out, and has so fully dwelt on. Now, supposing that the ships are not travelling towards each other at so wide an angle as a 4-point bearing, but travelling more nearly towards each other, the nearer y points towards x , the nearer must x point her bows towards y , if she wishes to avoid all danger of y getting within her circle. Take, again Fig. 5; there the very same thing, I think, is shown. Directly one vessel turns the least away from the other, she at once places herself in a position of disadvantage, unless she has something to make up for it, either speed, or turning power, or better stomach or eye in the body of the man who commands her. That is a point, that of meeting straight end-on, which I think requires to be very well looked into, and about which everybody who has to command a ship should thoroughly make up his mind; because that seems to me a position in which ships will again and again find themselves, pointing directly to their adversaries, and the first Commander who flinches, no matter from what cause, either from want of stomach or from want of eye, will put himself at a disadvantage. Other things being equal, he may recover himself, but once he has flinched, once he has slackened his speed, he has put himself into a position of disadvantage, that is to say unless he knows and allows for his opponent's state of mind and intentions. One can hardly follow out the arguments on Fig. 5, unless one imagines an advantage on one side or the other, but, supposing the ships to be equal in all other respects if they meet, the advantage will be to the ship that is most strongly built. In all the other points of bearing in which ships are supposed to approach each other, there is one thing which seems to be essential, and which, I think, it will be well for everybody to keep his mind upon, that is, the importance of improving our compasses. I do not see any prospect of a ship being able to manœuvre with success, to approach his adversary in such a manner as to give the decisive blow, unless the Commander is able very nicely to estimate both the line that he himself is proceeding on, and the line that his opponent is proceeding on. To do this, if you are in an open sea, you must have the assistance either of very accurate compasses, or you must be in a position near to land, where some objects on the horizon are distinctly marked out, and by the transit of your opponent past those objects you may estimate pretty well what he is doing, the rate at which he is moving, and how you may best hit him. I remember that when the Channel Squadron was entering Gibraltar there was rather an expectation on board one of the ships during

the evolution in which the lines were crossing each other, of two ships coming in collision. But I believe the fact was that the person who was conning the ship that was supposed to bring the other into danger had the opposite shore in view the whole time, with a perfect knowledge of all that was going to pass, and that he placed his ship exactly where he meant to place her. That was entirely due to the shore being in sight, and to the transit of the other ship past the points of the land being easily observable. To be able to do the same kind of thing in the open sea, you must have very accurately graduated, sensitively moving, and at the same time very steady compasses. These are very difficult things to get in one compass, but it is very desirable to have them, and it is very desirable that we should keep that very important object in view. There is one other point in which I entirely agree with Captain Colomb, that is the advisability of having high turning powers in our ships, to a certain extent that must be superior to the advantage of high speed. But there is an equation between the two to be arrived at. Anybody who can give us such an equation will confer the highest benefit on the service. It is to be arrived at by calculation and experiment, but I am afraid we are not in a position to arrive at it yet. I should not like to sit down without saying how much we ought to seek for opportunities to perform such experiments as the Russians have been making in the Baltic for some years. Those experiments are of incalculable value; if we cannot perform them in our big ships we must try by united representations to get them performed with gunboats, and, if we cannot have gunboats, then with models on the table. Whatever we can do towards ascertaining the powers of equal ships at equal speeds in combat I think we are bound to do for ourselves.

Captain HARVEY GILMORE: Captain Goodenough made a remark about the desirability of having good compasses in our ships. I do not know whether you have seen Lord Caithness's compass, which is the most perfect one that was ever made. The oscillation is reduced to a minimum, and the heaviest guns can be fired without making the compass spin round, as compasses do now when heavy guns are fired. At the same time it is very sensitive and good in every respect.

Captain ARTHUR: It is useless for four or five degrees of rolling, the friction is so very great.

Captain MONCRIEFF: In making one or two remarks upon this subject, I shall confine myself entirely to that part of it relating to guns. It may interest this meeting to hear a statement connected with the application of a new system of mounting artillery in ships which I have brought forward. Captain Colomb has alluded to the relative decrease in power of guns in vessels. The new system will have a tendency to restore that power. This drawing represents a vessel of the "Devastation" class, which I take for example, and we will suppose that this is a plan of the deck. The centre part, or breastwork, is placed somewhat in this manner. These vessels are intended to carry two turrets with four 35-ton guns. The statement which I wish to make is this, that in place of these turrets with four guns, six 35-ton guns can be mounted upon the new hydropneumatic carriages, with the following extraordinary results, that thereby you have increased the armament of these vessels, and yet leave a large margin of weight to be disposed of, or else the size of the vessel can be reduced for the same armament. With the Moncrieff arrangement in place of the turrets, five guns fire to the front in line of keel, and six on either broadside, the funnel, engine, ventilators, and boats being in the middle, as with the turrets. You will observe in this case that, taking the three bow guns, the centre one is only capable of firing on the same conditions as the turret, that is to say, with it you cannot fire with any great depression, on account of the bow. But if the vessel is a little cut away the other two guns can fire straight forward, and yet have a good many degrees depression; not only, however, can these guns fire to the front, but also two of the stern guns alternately, which makes five guns on line of keel; there is no turret in the way, you can, therefore, fire straight over the front guns. The horizontal port closes by the recoil, so that the heaviest charges can be fired over the heads of the men by another gun in rear of them, without either inconvenience or danger. Again, on the broadside you can fire four guns with maximum depression, and two with small depression on one side, or six guns on either broadside. If this arrangement is adopted for the "Devastation" two more guns are thereby obtained, but I maintain at the same time that much greater power than one-half more is got,

because I believe it is acknowledged both by naval men and artillerymen, that the twin guns in turrets (putting aside the inconvenience of muzzle-pivoting) have not the same power as guns acting individually; they are obliged both to be in the same line at all times, and, of course, if a turret is disabled two guns are disabled by one accident. Therefore, this arrangement of six guns, instead of four guns, gives an increase greater than at first appears, and, moreover, leaves a margin of a very large amount of tonnage to be disposed of either for carrying a larger quantity of fuel, or for increasing the armour. I hope that this statement, which you will find to be correct, will not be considered foreign to the subject before the meeting.

Captain SCOTT, R.N.: I think this is a very important subject, requiring much careful consideration. I followed with a great deal of pleasure the clear statement in which Captain Colomb described the ramming process. But it seems to me that he has given too great prominence to it. We have heard just now from other speakers of the importance of the torpedo, and of the probability that it will greatly interfere with successful ramming. If that should be the case, it must again bring the gun into its old place; but I am very far from admitting what Captain Colomb says as to the decreased value of the gun; I do not think it will be found at all to be what he imagines in actual practice. He says the gun has receded, and has drawn up a table to prove this. I think if you go more closely into the matter it will be found that the gun has not receded. We have placed very heavy plates on the sides of our ships, but these plates are borne upon light bottoms, and at present we do not know what will be the effect of hitting them. From what I have seen at Shoeburyness, and having afterwards considered the subject very carefully, it appears to me very doubtful whether under fire these plates will remain long on the side of a ship. If the plates come off, the ship will get a heel and be liable to attack on the weak parts which were previously under water. Even supposing you do not knock off portions of the armour, there will be a great deal of plunging and other fire, which will strike the ship very often in parts that are vulnerable. Ships do not always keep upright, but will be hit frequently when heeling over. As far as accuracy goes, I think steam has tended to very much increase it. At the present time we have very few relevant experiments, and our men are not well drilled, consequently are not on a par with the weapons they are called upon to use. But, hereafter, we may look for much greater accuracy of fire than we now obtain. The subject, however, has so many aspects that it is most difficult to draw the line between the relative value of the different weapons. It seems to me that to place the value of one weapon prominently before that of the other is a mistake, for all should be made as perfect as possible to meet the varying circumstances of warfare. Doubtless ramming will be the first mode of attack; that is, squadrons and vessels, if they are powerful enough to ram with advantage, will endeavour to do so. The gun will also hold just as important a position as it has ever done; and the torpedo will supplement the gun, and be a very effective weapon. With regard to the light vessels spoken of by Captain Colomb, if you have a vessel of 1,000 tons, how are you to iron-plate her, or even put an armoured belt round her, and give her speed? You cannot efficiently armour-plate a small vessel, and in merely giving her a belt round the water-line you expose her to be shot through sides and bottom from above the belt by a larger vessel. Again, with regard to the ramming, I think the proper way to use the ram is to advance end-on, and then the heavier vessel would catch and sink the lighter one, therefore I do not hold with the idea of building small vessels in lieu of large vessels. I think small vessels will be found not only unsuited for rams, but for the general services of our Navy. England is strong, but England's strength depends upon her long arm and her powers of offence. She must have vessels that can go to all parts of the globe, and can carry large quantities of coal, with heavy guns and large numbers of men. We cannot put large numbers of men, heavy guns, powerful engines, and large quantities of fuel into small vessels. Therefore large vessels are a necessity; large vessels will be the more powerful rams; large vessels will give a better means for firing the torpedo, and will also give the best platform, not only for the heavy guns, but also for the smaller guns, which must supplement them.

Commander H. W. BRENT, R.N.: I think Captain Colomb's data require examination, and to examine them they should be carefully read, and corrected if needs

be. The subject wants a great deal of study before we can discuss it. I must content myself with one or two remarks, having had the pleasure and benefit of discussing with Captain Colomb the battle of Lissa many years ago, when he held that guns were getting to a minimum of use. When I was serving afloat I took notice of firing when practising at a target, and found that we had the greatest difficulty in keeping the target in view, owing to the smoke of the gun; and I came to the conclusion that the smoke of the guns would be a nuisance to you in conning the ship, and that therefore you would fire but little. I found in the "Excellent" they were teaching ship's companies to fire very little in action. They were teaching them in this way, that the men should be so quiet at quarters that they would stand steady under all circumstances, and they were looking round for mechanical means to fire all the guns together. They had an electric system; and I see in the "Monarch" they have a mechanical system by which they fire the guns together. It appeared to me they were seeking for some means by which one person might fire all the guns together. With the men being taught to be quiet and the annoyance of the smoke of the guns, I arrived at the conclusion that you would fire them in action very little, only in passing your opponent, and that the ram would be your best weapon of offence. Expressing my opinion on the subject, I was told that the end-on fire was everything, that the end-on fire was the most useful of all. We had two bow guns in the ship I was in, and firing at a target, I found their smoke was more annoying than that from broadside guns when they were fired, and it was more difficult to keep the ship on the target. Therefore it appeared to me that the only time to fire bow guns would be when using your ram as you touch your opponent, and at no other time would you fire them, because they would be such a nuisance to you. Afterwards it was my fortune to see how Harvey's torpedoes were used. From the first, when I saw them, it seemed to me that we had got something that would frighten us from ramming. I quite agree with Captain Dawson that it would be a very dangerous thing to try to ram a ship if you found her bristling with torpedoes. Of course you might miss a ship, and to miss a ship with a torpedo astern would be certain death to yourself. At present it is very difficult to say where we are; we do not know; we are all abroad. Therefore I wish this discussion had been postponed, that people might have had the opportunity of studying this paper of Captain Colomb's. It is of such vital importance that it requires very careful looking into. As to the experiments that have been tried in the Baltic by the Russians, I think the same thing ought to be tried in the Solent by ourselves. Officers of all classes on half-pay would only be too glad to take part in them; it would teach them so much. I hope the mention of those experiments in Captain Colomb's paper will be the thin edge of the wedge that will cause us to have experimental ramming, and experimental attack and defence with our ships.

Captain WHEATLEY: Will you allow me to suggest that the experiments might be carried out with the steam launches of those ships that have steam launches.

Admiral of the Fleet Sir GEORGE SARTORIUS: As Captain Colomb has been kind enough to allude to me in a complimentary manner on a subject in which I have taken a great deal of interest, I should wish to say a few words in reply; but as I am confined to ten minutes, I can touch only very slightly on the matter. I have long advocated the ram as the re-introduction of the ancient mode of fighting. It struck me that the use of steam as a motive power would enable us to use the ram with considerably greater efficiency and effect than the ancients could have arrived at. Since 1855 and 1856 my attention was more particularly drawn to this mode of attack. Without entering into detail, I would simply enumerate the conditions and circumstances under which the ram can be of the greatest service, and show its power and greatest effect over every other class of vessel. I will suppose a squadron of eighteen or twenty of the finest vessels that can be got, whether from Russia, France, or England; let there be one ram without a gun, without any armour-plating, but very rapid, and very handy, with much more speed, of course, than any of the vessels that she is going to attack; that this vessel has coal on board which will not emit smoke, when she accompanies this large fleet. By her superior speed she can always avoid an action when it is convenient to her, and she can make her attack when it pleases her. Granting me those two points, she accompanies this

squadron, take for instance, of twenty vessels. The night is dark; the ram carries a kind of jury mast, which she lowers down; she is low in the water; she sees every one of the larger vessels that she is accompanying by their high hulls, tall masts, and funnels; she runs down at the rate of ten or twelve knots upon any one of the vessels that she has fixed upon. I will now ask any sailor; here is a ram running down at night on the vessel that she is going to attack; she makes use of a fuel that emits no smoke; she has lowered down her masts; she is not seen until almost the very moment when the look-out man calls out, "The enemy is upon us," which can be but a very few seconds; how is it possible for any of these large vessels, particularly large broadside ships, by any action of the helm to avoid the ram in so short a time? Even if the vessel attacked is able to fire two or three guns, a vessel at night with a narrow bow presented to the broadside ship she is going to attack, how is she to be seen? She is more likely to be felt before she is seen. What is the chance of her being hit? To suppose in war that you are to be so perfectly protected that no shot can penetrate, that there is no life that can be lost—in such cases like the iron boxes we now make which are perfectly secure, but these can do very little mischief to the enemy—how can their guns be fired with any chance of hitting this ram before the latter gave the blow? It is impossible she can fail in doing that because there is nothing to disturb her; she fires no gun; there is no smoke to confuse her or bother her; she gives the blow, and the blow that is given with the force of *sixty or seventy* thousand tons, what vessel can resist that blow? Mr. Reed, who was one of my first opponents in 1855 and 1856, in his pamphlet admits that there has been nothing invented by human genius that has the power of the ram for naval purposes. I admit that the turret will be a more formidable enemy to the ram than broadside vessels. But at night the turret vessel has no time to fire with any chance of success. Then, again, suppose Spithead full of ships, as it was at the review, what is to prevent a ram coming in at night into Spithead or at daybreak, and running through the ships at anchor, hitting away right and left? What chance is there of a battery striking her when she is among the shipping? What battery can fire upon the ram without striking more friends than enemies? There are only two cases out of many where the ram has an enormous advantage over a very large number of the most powerful vessels that can be built by any nation. In a single action, of course, it is more difficult. The only point upon which I rather disagree from Captain Colomb is, that for the unarmed ram I think extreme speed and extreme handiness are indispensable. But these qualities are equally important for an armed ram. I advocate three classes of rams. But to show the special power of the ram as a ram, I shall content myself with quoting the case of the unarmed ram. These vessels can also carry much more fuel. Therefore, from the circumstance of being accompanied by a vessel of this kind which is able to carry a much larger quantity of fuel, and to make feints, the vessels of a squadron that are liable to be attacked by her, these vessels will be constantly keeping up full steam; and in the course of a very few days they will be lost from want of steam. When it is a stern chase, by the ram having speed, her tactics will be to get under the stern and to destroy the steering-gear of the ship she is going to attack, then she can deliver her blow with perfect safety. With regard to Captain Dawson's observations about the torpedo, I think the ram can be a torpedo vessel as well. Therefore, without entering into other details as to the expedients by which the attack of the torpedo might be very easily overcome or evaded—this is, however, not the time or occasion to enter into that question—I simply repeat it is undeniable that the ram can be a most effective torpedo vessel and a ram, also equally effective.

The CHAIRMAN: Perhaps Captain Colomb will now reply to the observations that have been made.

Captain COLOMB: There is not much for me to say, in reply. Captain Dawson expressed his opinion that the torpedo has now become the leading weapon, having taken, in point of fact, the ground that was occupied by the ram. I agree with that to a certain extent. Captain Scott spoke in the same strain. I had already met the opinion of both these Officers in this paragraph:—

"Wherever the Harvey torpedo makes its appearance, whether in company with guns and rams, or by itself, it is still speed which must carry the day. Whether one ship determines to use his guns or his ram, he must try his speed and his

"torpedo, if the other chooses to adopt that mode of attack. *y* could not, as in Fig. 2, diagram III, turn towards *x*, and allow him to cross his bows: he must turn away from him, and trust to his own torpedo to keep *x*'s ram clear of him. Hence they come to parallel courses, and artillery fire, broadside to broadside. The struggle will immediately be, which is to head the other, and whichever can succeed must be victorious. The tendency of the Harvey torpedo seems thus to be, to bring the gun forward again, as the tendency of the ram has been to push it back. While this struggle for precedence continues between two torpedo vessels at short range, much damage must be done by artillery; and if the speed of the ships is nearly equal, the combat might be decided by a broadside action of the old type, except that it is carried on at high speed."

Captain Goodenough required some explanation as to an early statement in my paper with regard to the firing of the "Monarch." In the first part of my paper I said one round in three minutes could be fired, whereas afterwards I quoted it as being one round in two minutes. The history of the anomaly is, that in the first instance I quoted the opinion afloat as to what the rapidity of fire would be in action. Afterwards I corrected that opinion by data, in order not to be too hard upon the guns; in point of fact, I gave them the full benefit of any doubt that might exist on the question, and cut an extra minute off, because it is possible to fire one round in two minutes—consequently, I allowed that it would be so. I do not quite understand Captain Goodenough's remark in reference to the "Monarch" and the "Hercules," and the method of considering the end-on fire. But I do not think I need go into it, because I only spoke of those two ships as *rams* combined with *guns*. My argument only goes so far as to say, that if you are to make the ram your superior weapon, then you do not care for a large arc of fire, and you do not care so much for end-on fire. If, on the contrary, you are determined not to use the ram as your weapon at all, then you come to a totally different state of affairs; then you require a large arc of fire; then you come to the position given to *y* in Fig. 5, diagram I, because she does not mean to use her ram, but her guns, and she means to use the latter in peace and quietness while the other uses her ram. She does that by bringing her adversary end-on. Captain Scott alluded to the use of light vessels and the possibility of destroying them. But you cannot destroy light vessels with a few heavy guns, the number of fired shot will be so small. To attack a light vessel, you must provide yourself with a large number of light guns, as well as heavy guns, in order to give rapidity of fire, in order to give a fair proportion of hits on your object.

The CHAIRMAN: I think we must all have arrived at one conclusion on this occasion, that of being very much obliged to the lecturer for the lucid manner in which he has brought the subject under our consideration, and for having brought out the discussion we have listened to. A subject of this magnitude must produce great differences of opinion. We have heard some expressed here to-night. The object is to set men's minds thinking, and in the interim between this and another lecture in continuation of the same subject, we shall be, perhaps, better prepared to enter into the merits of the subject in all its bearings. This, however, will not detract from the thanks that are due to Captain Colomb on the present occasion.

Ebening Meeting.

Monday, April 17th, 1871.

VICE-ADMIRAL SIR FREDERICK NICOLSON, Bart., C.B., Vice-President, in the Chair.

NAMES of MEMBERS who joined the Institution between the 3rd and 17th April, 1871.

LIFE.

Turnour, Honourable Keith, Lieutenant 60th Rifles.
Hayne, Charles S., Capt., 2nd or South Devon Militia.

ANNUAL.

Harbord, J. B., Chaplain, R.N.
Turner, T., Capt., 26th Regiment.
Fitz-Patrick, Honourable B. E. B., Cornet, 1st Life Guards.
Hatton, Villiers, Lieut., Gren. Guards.

ON THE MILITARY BREECHLOADERS OF PRUSSIA, FRANCE, AND ENGLAND.

By Captain MERVIN DRAKE, Instructor of Musketry, R.E.

THE subject of military breechloaders has been so often and so fully discussed here, that it needs no introduction from me. I propose, then, this evening briefly to remark on the rifles used in the late Continental War, and to endeavour to bring before you the position of our own country as regards breechloaders down to the latest date.

The Prussians—I take them first, as having been the first to adopt breechloaders generally—used during the late war, and are still using, the same weapon which they used at Königgrätz in 1866, and the same which, patented in England in 1835, was adopted as the arm of the Prussian infantry in 1840—a date when in England, the first mechanical country in the world, as we are pleased to think it, we were still satisfied with the old Brown Bess, and with the flint lock which had lasted us for more than a century and a half. The needle-gun is so familiar to you all that I need not enter into any detailed description of it. I will, therefore, merely remark on the advantages and disadvantages which it appears to have when looked at by the light of modern experience of breechloaders. First, its advantages. It is strong; only two parts, the spiral spring and needle, are liable to damage; of these the soldier carries a reserve supply, and they can be replaced with great ease. It is simple. Its action depends on old and well-known mechanical principles. It can be made, as pointed out by Mr. Latham in this room, by any engineer accustomed to lathe work; it is taken to pieces, “stripped,” as we call it, without the least

difficulty and without mechanical knowledge; and it can be disabled in a moment by removing the breech mechanism. This last was an advantage claimed for it by the inventor, but one on which I confess I do not lay much stress, being inclined to think that a soldier who was so hard pressed that he threw away his rifle and ran for it, would not be very likely to stop to remove his breech mechanism as a preliminary measure. It is cheap. The fulminate being placed in front of the powder is less exposed to accidental ignition than if placed at the base of the cartridge, and perfect combustion is ensured. On the other hand, it has its disadvantages. 1. It is very heavy, weighing without bayonet 10 lbs. 10 oz. 2. It is clumsy. 3. It requires two more motions to load and make ready than are necessary with the best modern arms, the last of these, which I may call cocking, being somewhat hard to do, especially on a very cold day. 4. It is liable to escape of gas. On these two last points the Small Arms Committee report as follows: "The breech mechanism of this rifle was slower and more difficult of manipulation than that of many other arms brought before the Committee. * * * There was a great escape of gas at the breech." 5. It fires a paper cartridge; and all paper cartridges were condemned by the same Committee, as being more liable to injury by rough usage, damp, and exposure, and more liable to accidental explosion than the Boxer cartridge, which was made the standard. I am speaking now of the *present* needle-gun, the old pattern, such as I have in my hand, was loaded by emptying the powder into a chamber and then putting in the sabot and bullet. The cartridge is now made up as shown in the drawing on the wall. So much for description of the celebrated Zundnadelgewehr. I have recapitulated its good and bad points, because, although it has been familiar to many people, and especially to regular attendants at these lectures for years, it has lately been much talked about, and there may possibly be some present who are not acquainted with it.

While the Prussians have used in this terrible war but one rifle, their antagonists have been compelled to use a variety. Indeed, most of the numerous breechloaders which have cropped up on "the supply and demand principle" during the last few years, are represented among the French arms in use. Of these it will be only necessary to mention two, as being Government breechloaders, the Tabatière and Chassepôt. The Tabatière is a conversion, like our Snider, which, as you see, it very closely resembles; it gets its name from the closing of the breech being so like the shutting of a snuff-box, and gave the lively little "Pantalons Ronges" the chance of welcoming it with the song of—

J'ai du bon tabac dans ma tabatière,
J'ai du bon tabac, Bismarck, en voudras tu ?
J'en ai du fin, j'en ai du rapé,
C'a serait bon pour ton fichu nez.

The Chassepôt, the adopted arm of the French, is, as you see, very much like the needle-gun in mechanism. Both being what are known as "bolt-guns," the principle being that of an ordinary door-bolt. Let us look at its advantages and disadvantages. Advantages:—

1. It is light and handy, weighing only 9 lbs. 2. Throwing a light bullet (380 grs.) with a comparatively small charge of powder (85 grs.); the ammunition is light, and occupies but little space. 3. Requiring one motion less than the needle-gun, it is quicker of manipulation. 4. Having Whitworth rifling it is capable, so far as the barrel goes, of giving great accuracy. 5. It has a very flat trajectory—a matter of infinite importance for general purposes of action. 6. It has a half-cock. I mention this because it is claimed as an advantage, not because I consider it so myself. On the other hand: 1. It is an expensive gun to make. 2. Like the Prussian gun, it fires a paper cartridge. 3. The end of the steel cylinder through which the needle works gets very hot and makes loading both difficult and disagreeable. 4. The india-rubber washer is apt to get burnt away. 5. The cartridge is difficult to make correctly. 6. The cap is difficult to make, the cap composition having to be put in wet and pressed. 7. The gun requires frequent cleaning. 8. The spiral spring gets dirty, and then fails to force out the needle.

The opinions on this arm given to the Small Arms Committee in February, 1868, by those who had tried it in England, or seen it used in France, were that it was liable to miss-fires; that though the trajectory was flat at short ranges, the accuracy was not good at long ranges; that there was a loss of power in consequence of the large size of chamber necessary to consume the paper cartridge; and that the india-rubber wad was liable to stick to the end of the needle cylinder and then get left in the chamber. The Committee themselves found the same difficulties in loading, and had many miss-fires.

These difficulties, owing chiefly to the use of a paper cartridge, might be obviated by the adoption of a metal one. But the Chassepôt, like the needle-gun, is, be it remembered, on the bolt system, and with that system there is always the danger of the cartridge being exploded when pushed up by the bolt, which happened to Sir Henry Halford at Wimbledon.

As regards the effects of the needle-gun and Chassepôt during the war, I have been favoured with the following interesting information from a gentleman, Mr. Pratt, who was employed as an Assistant Surgeon under the "*Croix Rouge*." He says that the lightness of the bullet used in the Chassepôt caused it to be very easily affected by wind. The half-cock (so-called) far from being a position of safety proved to be very much the contrary; all day long in the camps round Metz chance shots were heard going off, and many sad accidents occurred from this cause. The arm was very liable to foul; one constantly saw the men spitting into the breech and trying to clean it out with their fingers. Although the rifle would shoot true up to 800 yards, the men seem to have wanted musketry instruction, for Mr. Pratt says he has seen several crack shots trying to pick off outposts at 600 or 700 yards without success. He adds, "I believe that their implicit belief in the enormous range of their rifles was one of the principal reasons that the French soldier lost so heavily from want of ammunition at the proper time. It was no uncommon thing to hear a smart fusilade going on, and see the men firing away

"from the hip at 1,000, or even 1,100 yards, I need not say without 'any effect.'" The Prussian gun, he says, carried accurately up to 500 yards, and the men, not opening fire until nearly at that range, had ammunition left when they got to the terrible 200, where trajectory has ceased to matter, and a large majority of bullets find their billets. The difference in the wounds produced by the two arms was very striking. The Prussian skittle-shaped ball traversed limbs, in and out, doing but little damage. The wound of entrance is very small, sometimes hardly admitting one's little figure, and, strange to say, the wound of exit, in nearly every case, is very small also, the only thing to mark it being that the edges are everted. "I have seen," Mr. Pratt says, "cases where *four* apertures were made by a bullet traversing the anterior fleshy mass of both thighs, where the wounds of exit and entrance were not larger than a shilling, and where the wound healed up with only a slight suppuration along the track of the bullet. In cases where the bone was fairly struck, there was, of course, a large amount of mischief; but even then the bone in many cases was simply fractured across at the point of impact, with perhaps a slight exfoliation afterwards." Of the effect of the Chassepôt he speaks very differently. "The wound of entrance is small, *but with jagged edges*, whilst in some cases you might put your fist into the wound of exit. This is not always the case, but invariably the exit wound is large and most severe. In cases where a 'long bone' is struck, not only is the bone broken, but it is splintered for several inches, both above and below the point of impact, thus rendering amputation the only resource."

Here we have the results of high velocity and rapid rotation, as shown also by the experiments made by the Small Arms Committee on the 3rd of November, 1868, when, in firing at the body of a horse recently killed, the Martini-Henry, striking the near shoulder, smashed the shoulder-bone into so many pieces that it was like small shot; the bullet was cut out from the skin of the off shoulder, a piece of bone having been carried through.

I shall have to speak more particularly of the accuracy and trajectory of the Chassepôt when I come to compare it with English Government arms.

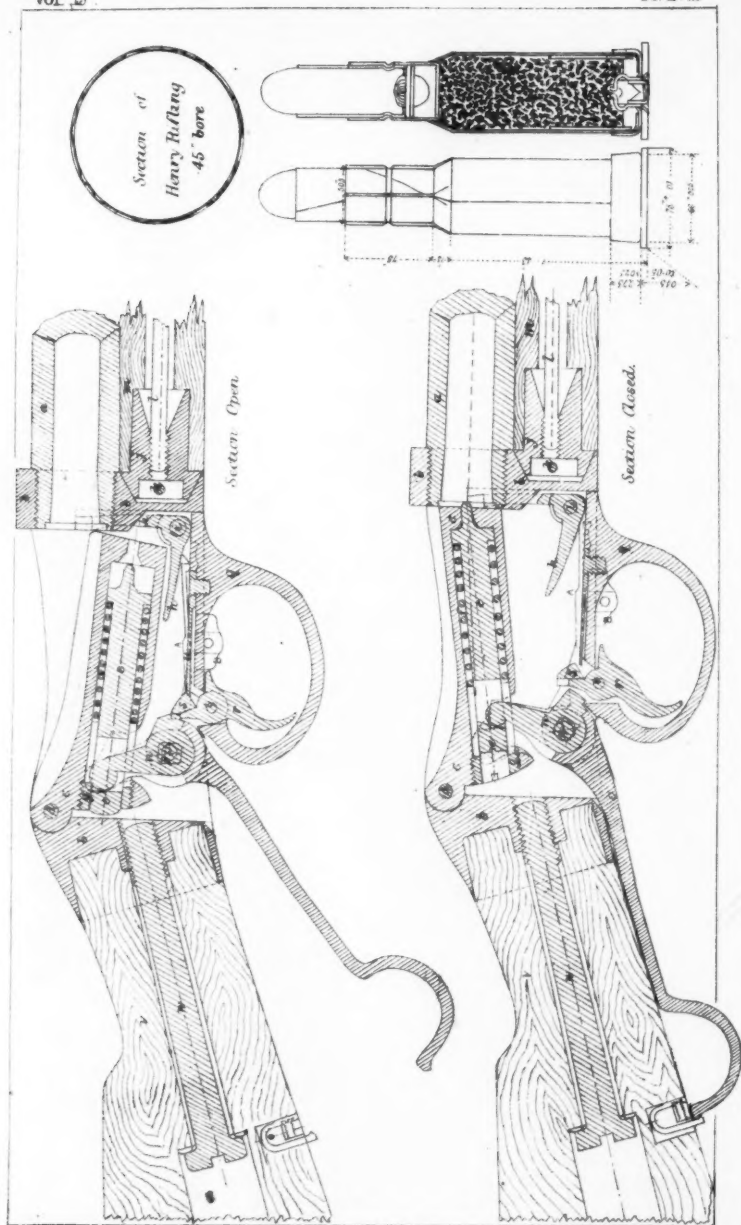
I come now to speak of English Government breechloaders, and shall confine myself to infantry arms. But first it will perhaps be desirable to recapitulate briefly what has been fully detailed in this room at different times—the history of our adoption of breechloaders for the infantry.

In July, 1864, General Russell's Committee reported that it would be desirable to arm the whole infantry with breechloaders. In August, 1864, an advertisement was issued, calling for proposed systems of converting the Enfield, and the Snider system was adopted. This system had stood well for the breechloading prize at Wimbledon, but failed to win entirely on account of the badness of the ammunition. Colonel Boxer invented a cartridge, Colonel Dixon improved the mechanism, and we had a breechloader at least as good as any continental army had at that time, and therefore quite good enough to do until further

experiment had proved whether a better could be found. In October, 1866, an advertisement from the Secretary of State for War called for proposals for breechloading rifles, either repeating or not repeating, the 5-grooved Snider-Enfield, and Boxer cartridge being the standards required, if possible, to be surpassed. Colonel Fletcher's Committee weeded the 104 systems to 9, and recommended that six arms of each system should be submitted to further trial. This was done. Evidence from Officers of experience, gunmakers, and others was taken by the Committee, and fresh trials of the nine selected arms of the previously rejected systems, and of 44 fresh ones, were made, resulting in the recommendation of the adoption of the Martini breech action, the Henry barrel, Boxer cartridge case, and Henry wad and bullet. 200 long-actioned rifles and ammunition were issued to regiments and ships for trial in December, 1869, and a Committee was appointed to collate and remark on the reports received. They recommended some alterations to be made in rifle, ammunition, and bayonet. In October, 1870, 22 short-actioned arms were issued for trial, and on the 8th February, 1871, the Committee made its final report, recommending the adoption of the short-actioned Martini-Henry rifle, short-chamber (or bottleneck) Boxer-Henry ammunition, and for land service the Elcho bayonet.

Perhaps I may venture here to make a few remarks on the action taken by Government in this matter, with reference to the numerous strictures that have appeared on the subject. It seemed to be desirable to get breechloaders; a Committee inquires into the whole question, hears the *pros* and *cons* (and remember that, at that time, there were very many *cons*), and reports that it is desirable. A means is sought of converting and utilizing the large amount of valuable arms in possession; in about six months we have 40,000 breechloaders better than those in use by any army in Europe, and a Committee sets to work to find out what is to be the arm of the future. The constitution of this Committee has been much criticised, especially by disappointed inventors, and their friends. Who composed it? The President, a Field Officer of the Guards, of experience and known judgment, just returned from the American War; as members, two Musketry Instructors, approved by General Hay, the Chairman of Council of the National Rifle Association, himself a very good Enfield and small-bore shot, and a gentleman, who, besides being a first class deer-stalker, had won the gold medal by small-bore, and the silver medal by Enfield shooting in the Queen's Prize at Wimbledon. Surely a Committee competent to judge of the suitability of a rifle for the Soldier, the Volunteer, and the Crack-shot.

In their second series of experiments, this Committee strove to find the best barrel and the best breech action separately; then they put them together, and finding that their junction had not lessened the good qualities of either, they adopted the arm so made. The opponents of the arm still said, that the arm would fail in the hands of soldiers: Government then had it tried by soldiers; improvements suggested themselves, were adopted and tried, and from the results of these last trials, a pattern arm has been arrived at. Be it observed, also, that the Committee, which received the reports of trial and suggested the



alterations was *not* identical with that which first adopted the arm, only the President and one Member remained, four fresh officers were put on; for Lord Spencer was substituted Lord Elcho, who certainly could not be accused of being prejudiced in favour of the arm, and to satisfy objectors, Mr. Gregory, late President of the Institute of Civil Engineers, was added. Complaints have been made, on the one hand, that Government did not, on the recommendation of the first Committee, straightway arm the whole Army with the gun of their adoption; and, on the other, that they have acted *unfairly*, in "tinkering" up the gun to make it equal to the requirements of the service. What Government had to do, was to furnish the Army with the very best breechloader that could be got; and I submit that the course taken was admirably adapted to accomplish that object. Surely it was better to go on improving where possible; all private inventors have done so, the latest patterns of their breechloaders differing in many points from those of a very few years ago; and, as regards the delay, surely it would not have been wise to make expensive machinery to turn out guns, which experience might prove, as it has proved, to require minor alterations. It being always borne in mind that all this time we were not unarmed; we had an excellent breechloader in the Snider, about which I must say a few words, as it will probably for some time be the arm of our Reserve Forces. The Snider-Enfield is, as you know, the Enfield rifle of 1853 converted into a breechloader, on the system of 1537, as shown in Henry the Eighth's gun in the Tower; its accuracy, therefore, is simply that of the Enfield; briefly, it shoots fairly up to 600 yards, badly at longer ranges, and has a simple and (as improved) safe breech action, giving considerable rapidity of fire,—the *extreme* rapidity was, I think, stated by Captain Majendie to be 15 rounds per minute. Altogether quite a good enough arm to trust to until we could get a better one, and learn to avail ourselves of its superiority. Until the Emperor adopted the Chassepôt, I believe that the Snider-Enfield was the best "arm in use."

I now come to the most important part of my subject, the "arm of the future," the Martini-Henry rifle. Every breechloader consists of three component parts—barrel, cartridge, and breech mechanism; and although these three are so entirely dependent on each other, that the value of an arm can only fairly be estimated by considering the three as forming one harmonious whole, yet, for convenience sake, I may perhaps be allowed to speak of them separately. They have been so well described in this room by Captain Majendie, that I will only give a brief description for the benefit of those who may not know the rifle. First, then, the barrel. This is the invention of Mr. Henry, the Edinburgh gunsmith. It has seven grooves, as shown in the drawing; its length is 2ft. 7 $\frac{3}{4}$ ins., its weight 3 lbs. 6 $\frac{1}{4}$ oz.; the grooving has one turn in 22 inches, the 3-grooved Enfield, it will be remembered, had one turn in twice the length of the barrel, or 78 inches. As a proof of its accuracy, I give the following summary of results obtained by taking the average of 5 targets of 20 shots each:—At 500 yards, .95 foot; at 800 yards, 1.47 foot; at 1,000 yards, 2.80 feet; at 1,200 yards, 3.46 feet. The accuracy of the Henry barrel, however, is well

established. Mr. Westley Richards has adopted it for his new and excellent breechloader in place of the one he formerly used, which was an application of the Whitworth system. The bore is .45, the calibre found, after long experience, to give the best combination of accuracy and trajectory.

An infantry arm, now that there are no special sharpshooter corps, has to fulfil two conditions: to give great accuracy at long ranges, so as to enable marksmen to oblige an enemy to keep out of its reach, to annoy artillery in the field and working parties at sieges, and also to be a deadly and effective weapon when fired into masses of men at comparatively short ranges; and for this latter condition flatness of trajectory is eminently necessary. The aim taken by troops in the heat of action at an enemy within 300 yards of them is not likely to be very careful, nor is much attention likely to be paid to the adjustment of the back-sight; the arm, therefore, which will be least affected by mistakes on this point is, *cæteris paribus*, the [most valuable for short ranges. At 300 yards, the greatest height of the trajectory of the Henry barrel, using the Boxer-Henry ammunition, is 2' 7" above the horizontal line of sight; at 500 yards, it is 8' 2". By this table of velocities of the Chassepôt, Martini-Henry, and Snider-Enfield, calculated by Lieutenant Sladen, R.A., you will see that the Henry, though starting with less initial velocity than the Chassepôt, holds its velocity better in consequence of the greater weight of the bullet. At 150 yards you will observe that the velocities are nearly equal; from this point the Henry takes up the running, and at 500 yards its bullet is travelling 30 feet a second faster than that of its French rival; but the Henry bullet would not overtake the Chassepôt until 450 yards, which distance is accomplished as follows:—

Chassepôt in	..	..	..	1.28269 second
Martini-Henry in	..	..	..	1.28200 "

At short ranges, then, the Chassepôt has a flatter trajectory than the Henry, but at longer ones the advantage lies with the latter and increases with the increase of range. Of course the trajectory of the Henry could have been flattened by using a lighter bullet, such as the Chassepôt of 380 grains, but the difference was found on experiment not to be sufficient to warrant the sacrifice of accuracy which would have followed as a matter of course. The Henry has also the great advantage of being less affected by wind.

The penetration given by this rifle is very good, as shown by the following facts. The Henry penetrated 17 half-inch elm planks, one inch apart, from 30 yards; Snider failing after the ninth; at 100 yards, the Henry went through three balks of dry fir and one of green fir, each 3 inches thick; at 350 yards, the Henry went through a mantlet, consisting of four thicknesses of 3" rope, which was proof against the Snider at all ranges; at 25 yards it went through an ordinary gabion filled with earth and also through a sap-roller, both of which were found proof against the Snider at 10 yards; at 100 yards, it went through a filled sand-bag in one case only. It was commonly urged against the introduction of a small-bore rifle into the Service, that it

would not stop large game, such as horses and men; "that it was well known to Indian shikarrees that to stop large game of any kind you *must* have a big bullet; that a small bullet travelling at a high velocity would simply go through, making a small flesh wound." The following experiments would go to prove that this fear was somewhat groundless. They were made on a horse directly after death.

Henry, at 45·50 yards, broke thick part of thigh-bone of off hind leg; the bullet remained in, the bone was smashed to pieces. Henry, at 45·50 yards, struck near shoulder, smashed shoulder-bone into so many pieces that it was like small shot; bullet cut out from skin of off shoulder, a piece of bone was carried through. On these experiments Veterinary Surgeon Harrison, R.H.A., who was present, reports: "The smaller bullets appeared to me to produce the most severe fractures, the larger ones more disposed to flatten and traverse the soft tissues adjoining the bones."

So much for the barrel. Now for the breech action, on which, after long and anxious experiment, the Committee decided. It is called the Martini, having been originally entered for competition by Mr. Frederick von Martini, of Switzerland. In the original competition it stood but seventh in order of merit, having been wedded to an inferior barrel and supplied with faulty ammunition.

It is on the falling-block system of the Peabody and the present Westley Richards, and various other rifles. The breech-block falls and rises on a hinge, and is worked by a lever behind the trigger-guard; this block contains a spiral spring and piston, which is driven directly into the cap of the cartridge. The action of opening the breech throws out the empty case by means of a lever extractor, and at the same time cocks the rifle. In lieu of half-cock, a position of safety is obtained by means of a sliding-bolt. It passed satisfactorily through the very severe tests to which the arms were subjected by the Committee, viz., carefully covering the action, both opened and closed, with fine-sand; using purposely damaged and extra sensitive cartridges; exposure, and rapidity. On one occasion, after exposing the arm to the influence of rain or of water, artificially applied for seven days and nights, it fired 20 rounds in 1 minute 3 seconds; the breech action worked as smoothly as it had done when the arm was clean, and in every case the extractor ejected the cartridge. When taken to pieces and examined, the block containing the spiral spring was entirely free from rust, and the other portions of the breech mechanism were only slightly discoloured by it. For rapidity, Captain Mackinnon fired 20 rounds in 48 seconds.

The ammunition known as the Boxer-Henry consists of a Boxer-coiled case, made in what is known as the "bottle-neck" form, to avoid extreme length, containing 85 grains of Waltham Abbey No. 9, or Government K, powder, a wax lubricating wad placed between two jute wads, and a Henry bullet, which is solid, and hardened with one-thirteenth of tin. Its weight is 480 grains.

Putting then the parts which I have so briefly described together, we have the Martini-Henry rifle with its Boxer-Henry cartridge.

The arm has been very fully criticised, and it will be interesting to try to find out the value of the many objections which have been raised.

These I will separate into two classes; 1st, those found to exist on actual trial when the rifle was put in the hands of soldiers and sailors: and 2nd, those which have been raised theoretically against the arm considered as a piece of mechanism. I will take the faults mentioned in the reports of the officers who conducted experiments *seriatim*, and comment on them. Certain questions were addressed to these officers, and answered after each month of trial.

Question 1. "What accidents, if any, have occurred?" No accidents properly so called are reported; two cases, of rifles going off when not intended to, having evidently been caused by the actions having been "regulated" by the armourer-serjeant of the regiment.

Question 2. "What difficulties, if any, have been found on loading?" Many complaints were made under this head; in the majority of cases the difficulty was caused by the paper covering of the long cartridge which got "rucked up" and jammed the cartridge, or by the cartridges getting bent in the pouches (although it was very easy to straighten them by means of the breech action itself); a few cases were reported of cartridges with large base caps. The adoption of the short-action rifle with the bottle-neck cartridge and no paper, seems to have entirely got over these difficulties.

Question 3. "What difficulties, if any, have been found in extracting cartridge cases?" No difficulties were reported attributable to the arm. In this case, however, the short action does not seem to act *quite* as well as the long, more power being required at the end of the stroke of the lever.

Question 4. "Has the lever in any case been broken, or so bent as to impede the action?" No.

Question 5. "Has rust been found to accumulate about the breech so as to affect its working?" The answers to this question were most satisfactory. The exceptions were in the case of some rifles at Montreal, which are stated to have got very wet on three successive days, and to have been much affected by rust; and of a rifle at Hythe left accidentally at full-cock, of which the striker got rusted firmly into the block. On the other hand, at other places the action seems to have gone through rather severe trial successfully; for instance, at Rawul Pindie the arms were exposed for 42 hours to very heavy rain, dust-storms, and sun. Twenty rounds of blank were then fired from each arm without a miss-fire. One of five rifles which I had to try, was not cleaned once during the four months of December, January, February, and March, during which time it fired 3,102 rounds without a miss-fire. When I took it to pieces, I found but little rust, though a considerable quantity of dirt, which however did not in any way affect the working of the action.

Question 6. "Has the coil spring been found to become weak or inefficient?" With the long-action arms first issued, there were numerous miss-fires, attributed to defective mainsprings. On inquiry it appeared that instead of 40 lbs., the strength originally fixed by Mr. Martini, the springs of these rifles weighed only 26 lbs. Stronger springs were substituted, and the miss-fires have ceased. The strong springs have, however, increased the labour of loading, and given rise

to difficulty of arranging the pull-off satisfactory, which has, I believe, been overcome in the pattern arm now before you, but which I have had no opportunity of testing. For my own part, I liked the weaker coil-springs best. I fired many hundreds of rounds from the five rifles sent to me for trial, and I never had a miss-fire; it depended entirely on the way of pulling the trigger.

Question 7. "Is the action of the extractor in throwing out the empty cartridge case considered too sudden?" It was not found so, but it is less sudden in the new arm.

Question 8. "The stock being in two parts, has it remained firm and strong?" The screw bolts of some of the rifles became loose; this has been rectified in the new arm.

Question 9. "Has the butt end been found to shrink or become loose from the effect of hot dry temperatures?" A few cases are reported, but the new method of stocking will get over this.

Question 10. "Is any inconvenience experienced from recoil?" The replies to this question vary considerably, some regiments thinking the recoil greater than, some equal to, and some less than that of the Snider. The fact appears to be that the recoil is rather greater than that of the Snider, but is not sufficient to be any objection when the men become used to the arm, and it is to be hoped that, being armed with so good a weapon, they will have more opportunity of becoming used to it.

Question 11. "Is the weight of the arm a practical objection on service?" Here again opinions differed materially, the balance, however, being against the arm on this point, the long-action rifle weighed 9 lbs. 7 oz. Now all sportsmen will agree that in a long day's shooting, even partridge shooting in England, when one carries as little weight as possible, the weight of the gun makes a considerable difference in one's freshness, and man-stalking is at least as hard work as any other stalking, especially when you consider the weights to be carried besides the gun; knapsack, great-coat, sword, ammunition, haversack, and water-bottle. The Committee seem to have had this opinion, for the new pattern arm weighs but 8 lbs. 7½ oz. A 12-bore breechloader generally weighs about 7 lbs.

Question 12. "Is the position of the back sight approved of?" It was liked for shooting, but found to be in the way when carrying the arm at the trail. This was a question of balance, and the barrel having been shortened and lightened, the back sight is no longer in the way.

Question 13. "How does the sword bayonet answer as a weapon of attack and defence?" Generally approved of, but the position, or rather shape of the lever, found inconvenient. This has been altered, and a new pattern of sword bayonet, the Elcho pattern, has been adopted.

Question 14. "Does it answer as an implement on service for cutting wood?" The first pattern was not handy to use, it hurt the hand; the Elcho pattern seems to be approved of.

Question 15. "Are the cleaning implements found useful?" They were found so, but the cleaning rod worked loose in firing; this has

been obviated. A suggestion was made from various quarters that a *ramoneur* should be carried, such as is supplied with sporting guns and carried by the Americans; this would appear worth consideration.

Question 16. "Is the muzzle-stopper found generally useful, and "is it desirable to introduce it?" On this point opinions differed; the muzzle-stopper was liked in itself, but many people objected to a muzzle-stopper at all, on the ground that it is dangerous and likely to be lost, thereby putting the soldier to expense. Obviously, it is a good thing to have a muzzle-stopper in the rifle when it is not in use, and a bad thing when it is. Might not the stoppers then be fastened to the arm-racks instead of being loose? they would then afford protection to the rifle when in the rack, and could never be taken on parade or lost. If a rifle be cleaned after a man comes off guard, as it ought to be, surely it would receive no damage from the amount of rain which might possibly run down the barrel in one guard.

Question 17. "Has the ammunition been found liable to become "broken or damaged in transport or when carried in men's pouches?" The long cartridges got bent; the short ones seem better adapted to transport, though not quite so able to resist wet.

Question 18. "Has any difficulty arisen from this cause in loading or extracting?" The paper of the long cartridges caused difficulty, which no longer exists now that the short bottle-neck is adopted.

Question 19. "Is the form of the cartridge found convenient to use?" The short one is much liked.

Question 20. "Have any of the cartridges cut round the base?" On this point the evidence is satisfactory, only one instance of cut being cited with the new cartridges.

Question 21. "Have any of the caps given way?" No.

General observations were made by the officers conducting the trials as to their opinion of the arms, and suggestions as to minor alterations were offered. To give an idea of what the arm can do in the hands of soldiers, I will give you a few of the results obtained during our trials at Gravesend. Firing individually, giving each man a 2nd class target to himself, at 500 yards I found that a steady man would make about 20 hits in two minutes. In March I had an opportunity of having the rifles fired by a squad of recruit officers to whom I purposely gave no previous drill with it: they used it with the greatest ease, and made good practice. Some of them felt the recoil.

The general observations were very favourable to the arm, especially as regards the short-actioned one. It is commended on all hands for accuracy, not being affected in shooting by side-wind, simplicity of action, and durability. Some objections are raised to the platinum lines on the back sight, as not being easily seen when the light is in front of the firer; this might be easily remedied by cutting a small square notch in the centre of the bar, and smaller ones of the same, or even of different shape on either side. In fact, the objections *found* to exist in the first arm have been remedied in the present one, and may be considered got rid of.

So much for practical objections. Now for theoretical or imaginary ones. These, being matters of opinion, had to be so considered and met

by opinion. The last Committee, besides having among its members Mr. Gregory, late President of the Institute of Civil Engineers, took evidence from mechanical engineers of high standing, in order to find out whether the statements so confidently asserted as being those of "every practical mechanic" were in reality so or not, as, if they were, it was obviously their duty to institute further experiment, in order to find out whether these opinions were supported by fact before finally recommending as the arm of the whole British Army and Navy a rifle so radically wrong in construction as the Martini was supposed to be. They therefore examined Mr. Nasmyth, the inventor of the steam hammer, a gentleman with 40 years' active experience as a mechanical engineer; Dr. Pole, who was for many years Professor of Civil and Mechanical Engineering at University College, London, and was a member of the Iron Plate and Armstrong-Whitworth Committees, who had been brought up from his youth in a mechanical workshop, and been connected all his life with mechanical engineering; Mr. Woods, a Member of Council of the Institute of Civil Engineers, with 35 years' experience of mechanical engineering; Colonel Dixon, R.A., the Superintendent of the Government Small Arms Factories, through whose hands most systems of rifling and breechloading must have passed during his tenure of office at Enfield; Mr. Davidson, the mechanical manager of work in the Laboratory; and Mr. Perry, a practical gunmaker, with 16 years' experience at Enfield. It can scarcely be said that the witnesses called were not capable ones, and the vulgar suggestion, which I read in a paper the other day, of their opinions having been influenced by their retaining fees, is of course simply beneath consideration. We will examine the various objections which I have been able to collect *seriatim*. 1. The whole recoil is taken by the block axis-pin; if this pin gives way, the breech-block blows out. I have heard this objection urged frequently; the opinions of the scientific and practical gentlemen whom I have named show that theoretically this assumption is incorrect, and fact proves it still more conclusively. Lead block axis-pins have been used, and not bent in the slightest degree, and one regiment, while reporting on accidents, says that this pin, having become loose, and dropped out from one rifle, 40 rounds were fired without replacing it, and no inconvenience was experienced. This objection, then, is disposed of, both by theory and experience.

Objection 2. "The position of the lever is bad; it acts at the wrong end of the block, and it would be inefficient for elevating and depressing the block, and for retaining it in its place." First, as a matter of fact, the lever does elevate and depress the block with ease and certainty, and, as regards the support when firing, the Peabody block has no support at all, and yet is quite safe. As regards opinion, Dr. Pole considers that, instead of calling this a lever, it should be considered part of a system of toothed gearing; also, that the present arrangement being strong enough for its purpose, there would be no object in departing from it for the sake of a mere hypothetical advantage. Mr. Woods says, "The working lever possesses adequate strength for the performance of its various functions, viz., lowering, raising, and

"supporting the lock, cocking the rifle, and working the extractor." Mr. Nasmyth says, "So far as I am capable of judging, the working lever is placed in a suitable and convenient position, and has at the same time ample power for performing the duties assigned to it, and with every reasonable probability of doing so without undue wear and tear." Colonel Dixon quotes the case of the Peabody in proof of the sufficiency of support. Mr. Perry gives no direct evidence on this point. Mr. Davidson "considers the lever properly placed for the duty it has to perform." Experience and opinion seem again to concur in favour of the system. It is not contended that putting the lever at the other end would not be stronger, but that additional strength is not required.

Objection 3. The spiral spring (*a*) would rust; (*b*) would get weak with use; (*c*) would not give a sharp, but a pushing blow; and (*d*) is an innovation on a well-known and long-tried system of ignition. Mr. Davidson disapproves of the spiral spring; he thinks it would be liable to rust; that extreme cold would tend to snap it, extreme heat would weaken it; that great difficulty would be found in getting uniformity of material, although there ought not to be; that the spiral spring would give a pushing blow, although the one in the Martini action does not, because you have an overplus of force bottled up in the spring; that his experience of spiral springs in machines was unfavourable; that all springs are liable to failure, the spiral more so than the flat or lever spring; at the same time he thinks the form in which this particular spring is applied is very compact and convenient, and by storing up an excess of power may serve the purpose required, and that in its present form, combined with the striker, it is in the best possible position for applying the stored-up force in almost a direct line with the axis of the barrel, but thinks the limited space through which the striker moves an unfavourable feature. This, be it observed, is chiefly opinion, with the exception of the experience of the failure in certain machines; but, on further examination, it appeared that the springs of which this gentleman spoke were, by his own account, "not made of the very best material," "were roughly made," and "that their character could be improved by a system of careful selection;" also, that he "did not consider the spiral spring as at present applied to the Martini-Henry a positively objectionable feature." Let us then compare it with other opinions. Dr. Pole remarks that the spring and striker are completely housed, not only within the general case, but also further within the block, so as to get very great protection; says he has calculated the velocity of the blow given by the Martini spring to the cap, and finds it nearly 35 feet per second, while that of the main-spring of the Snider is only 30; that the spiral spring is used for railway buffers and chronometer balances, and found to answer; that it is applied to the Salter's spring balance of the safety valve of railway locomotives, where, if the force varied with age or use, the spring, and therefore the balance, would be untrustworthy, and therefore not used; in fact, he considers the spiral spring of considerable value, and an important feature of the action, as giving compactness, directness, and safety to the lock. As regards the innovation, he points out that in the old

side lock it was necessary to find a means of giving a downward blow to the percussion cap on the side of the gun, and that the somewhat, indirect action of the flat spring, swivel, tumbler, and hammer, had to be resorted to, but that now the necessity for this indirect action no longer exists, and we are able to come to a direct application of force to the centre of the cartridge. Mr. Woods thinks the action of a spiral spring more liable to be affected by rust than that of a flat spring; but that in the Martini action is sufficiently protected to guard against ordinary liability to rust; that a spiral spring can be made to resist great variations of temperature; that a permanent "set," or strength which the spring will retain, can be got by making the spring a little too strong at first, say 2 or 3 lbs. to the 40 required. Mr. Nasmyth is of opinion that the spiral spring and striker may be confidently relied on to perform their duties effectually and permanently. He says a uniform blow can be obtained; explains the "set;" thinks a spiral more durable than a flat spring, and says that he has had considerable acquaintance with the employment of spiral springs in machinery; speaks of Mr. Ryder's machine at Enfield, in which the spiral springs have to undergo 300,000 violent compressions and expansions in every eight hours, and there they have been at work nearly ten years without deterioration; that the spiral spring is more trustworthy and less liable to fracture than the flat gun spring; that it will give due momentum to the striker; that being well enclosed, and in an oil-retaining part of the apparatus, there is very little liability to rust; and that he thinks it one of the most remote of all causes of anxiety about the construction of this rifle; that they can be made perfectly uniform, and explains a process of hardening which would ensure uniformity. Colonel Dixon says, the more we (he and his workmen) examine the action of the spiral spring, the more we like it; that there would be no difficulty in ensuring uniformity in large quantities; that the price is about a halfpenny against 1s. 4d. for the flat spring of the Enfield lock. Mr. Perry approves of the spiral spring, and says there is no difficulty about the maintenance of the proper strength and regularity if the size and proper quality of the material be strictly adhered to. So far opinion against opinion; now for fact. (a.) Mr. Parry states that it was he who stripped the breech action of the arms returned from the troops; that though the bodies and blocks were rusty and dirty, when the springs were taken out they were covered with oil, as when first put in; there was not a symptom of rust upon them. (b.) An exposure to a temperature of 15° below zero at Montreal broke no springs; one report from India states the coil springs got weak towards the close of the experiments, but this is not confirmed by reports from eight other stations in India. (c.) The spring *does* explode the cap, which is its object, whether the blow be pushing or sudden. (d.) The flint lock was an innovation, so was the percussion cap, the rim-fire, and then the central-fire cartridge; it does not by any means follow that an innovation should not be an improvement, or we might go back to "hand gonnies," and let them off by means of a lighted stick.

Objection 4. An uniform pull of trigger cannot be obtained.

Dr. Pole says the pull varies from 4 to 7 lbs., according to the lubrication, but sees no reason why the variation should be greater than in the ordinary lock. Mr. Woods says the retention of steady pull will depend on the maintenance of uniform power in the mainspring, on the durability of the engaging surfaces, and on the good fitting of axis holes, and pins. The first condition I have shown can be obtained; the second is matter of fact, as I shall show hereafter; the third we may safely trust to the accuracy of the Enfield workmanship. Mr. Nasmyth thinks the pull-off can be kept as uniform as in the old lock. Colonel Dixon sees no difficulty in this point; thinks the pull might be made as light as 3 lbs. if necessary, and is of opinion that, after considerable use, there need be no alteration of pull. Mr. Perry thinks the same. Having had no means of testing the new pattern arm in this particular, we can only go by the balance of opinion, which refutes the objection.

Objection 5. "That the parts would wear out and the action become 'impaired.'" I need not trouble you with counter opinions on this subject. There are the parts of an action which has fired at least 10,000 rounds; they have been carefully tested by Mr. Woods and Mr. Nasmyth with the standard gauges, and no sensible wear could be detected; the much-abused spiral spring even was as good as the day it started from Enfield. This disposes of this objection.

Objection 6. "That the safety-bolt will stick." All the witnesses pitch upon this as the weak point of the mechanism. Dr. Pole, while thinking that the principle of the bolt itself is good, says the mechanism is delicate and the motive power applied at a disadvantage; Mr. Woods thinks it delicate and liable to stick, but that it might be easily remedied; Mr. Nasmyth thinks it should be more substantial; Colonel Dixon thinks it strong enough for its work, but that it would not be used, and would prefer an automatic bolt to work with the action; Mr. Perry thinks the same.

Fact goes to prove that the safety-bolts did not break on trial except when the action had been dismantled and improperly remounted; but this may, and probably was, caused by the fact that the safety-bolts were never used. My own experience was that the safety-bolt was inconvenient to use, being liable to stick. Personally, I am of opinion that no safety-bolt is required; that a breechloader should *never*, under any circumstances, be loaded except at the moment of firing, and feel convinced that that is the best safety-bolt. Since the introduction of breechloaders, I have never allowed my men to load in the ranks, only when they step out to the front to fire. All you want is a pouch from which you can get a cartridge in a moment, the loading itself is a matter of almost no time with the Martini.

Objection 7. The stocking, being divided, is weak. Here, again, I will give you facts. Experiments made at Enfield showed that the strength of the Snider-Enfield and Martini, when used as clubs, was about equal. Both remained uninjured by a fall of about 4' 6"; both were broken by violent blows, but with this remarkable difference, the Martini broke in the small, or the stock-bolt broke, while the Snider broke across the lock, showing that its weakest part was where the

wood has been cut away to a mere shell to admit the block and lock. An alteration in the metal and method of fixing the stock-bolt and doing away with the "trap" in the stock, will make the new arm stronger than the old.

Objection 8. It is difficult to dismount and remount the action. Dr. Pole says, "It is at present a little more difficult (than the Snider), on account of the knack for getting out the block, but that is very soon learned. The Enfield lock requires a cramp to be used, a turn-screw alone is required for the Martini." Mr. Woods thinks an intelligent private soldier could do it if well instructed. Mr. Nasmyth says a man of a very ordinary degree of intelligence and handiness could undo all the parts, and dis sever them and put them together again, with the greatest ease and rapidity. Colonel Dixon calls it rather a nice operation, and does not think you could instruct every man to do it; remarks that the armourer-serjeant is the proper person to do it, and not the private soldier. Mr. Perry thinks a non-commissioned officer or intelligent soldier could be instructed to do it. Having had considerable experience in the instruction of recruits in dismounting and remounting locks, and having taken down and put up the Martini action, I must say that my opinion agrees with Colonel Dixon's,—a good deal of knack is required, not to get the block out, but to get it in again. I saw an armourer-serjeant fiddling at one for 10 minutes, with the printed instructions before him, and had to do it myself at last; and people who know how to do it cannot always do it on the first attempt; either it must be simplified or the soldier made to leave it alone, and there is no need for him to take it out. If dirt gets in, it does not interfere with the action of the breech-block or force of the blow, and periodical cleaning by the armourer would be enough to keep the arm in working order.

Objection 9. "The whole thing is unmechanical." This is the "bogus" objection, always kept in store to let off on people who venture to refute other objections. I have heard it raised with much effect by a person in a gunmaker's tent at Wimbledon, who said he "was a civil engineer, and must know." Mr. Nasmyth speaks of it as a "slang term in mechanism," and says "there is nothing unmechanical in any constructive arrangement that accomplishes its object; and if that object is accomplished in a simple and effective way that combination is good, and it is the best mechanical system that attains its end in the most simple and durable manner: he thinks the ends in question are very admirably obtained." It is objected, he says, that it is a lifting of the weight at the wrong end. The whole mechanism of the human frame is based on lifting weights at the "wrong end;" the muscles are all at the "wrong end," but they perform their functions well. Mr. Perry thinks the system the most simple and substantial one he ever met with (and he must have examined most of them): he adds the simplicity of this action, the manifest strength of its component parts, and its power, in manipulation, pointed it out (when sent with the other selected 8 to the factory), as being something out of the ordinary run of breech actions.

Should then the Martini-Henry be adopted as the arm of the Service,

we shall have a weapon giving, as far as the barrel is concerned, great accuracy at long ranges, combined with a very flat trajectory, and, therefore, fearfully destructive at the shorter ones, with terrible smashing power and great penetration, not liable to fouling, easily cleaned, and not injured by being left uncleaned, with grooves which do not lead nor wear out; a breech mechanism easily constructed by machinery, easily worked, not liable to get out of order, utterly unaffected by rust or dirt, wearing well. Putting the two together, a rifle quickly loaded, light, handy, strong, and durable. But if we are to have this gun we shall want more musketry instruction. It is of no use to put such an arm into the hands of men and not make them able to take advantage of it. It has often been urged that the Enfield barrel was quite accurate enough for the Army because its shooting was better than that of the men, the answer to which is evident. Make the men better shots, and give them a better arm. Ought we to have gone on with Brown Bess because our men could not shoot? If there be an advantage in having an accurate long range rifle, and in these days of rifled artillery and mitrailleuses no one will be found to deny that, then men *must* be trained up to the level of the rifle, not the rifle lowered to the level of the training of the men; and to do this we require more practice, 90 rounds a year is of little use in making a man a good shot or keeping him one. Ask any crack shot and he will tell you that he fires much more nearly 90 rounds a week when he is in practice. The Martini-Henry, though a very good breechloader, is still a breechloader with the principal fault of a breechloader, viz., the facility for wasting ammunition. Our men are no better than others in this respect: I have known men in the trenches, on a pitch dark night, fire away into the darkness as fast as their frozen fingers could load their Miniés at a perfectly imaginary enemy. With breechloaders they could do this with fatal ease. Soldiers are terribly apt to fancy that so long as they are firing, they must be doing good. The French soldiers, not well drilled to their Chassepôts, seem to have wasted their ammunition sadly, according to Mr. Pratt's account. In Colonel Walker's account of the Battle of Königgrätz, we are told that the Prussian companies, who occupied the southern skirts of the village of Rosberitz had exhausted their ammunition in an unceasing exchange of shots with the Austrian riflemen in their front, and were driven into the interior of the village by an attack which they had no longer the means of resisting; whereas on the same day five companies of the Prussian guard repulsed a whole brigade. I quote from Colonel Walker's lecture of the 20th June 1868. "Scarcely had the wood (of Lipa) been carried by the Prussians, when Austrian columns were perceived in full march against the heights of Chlum. Apparently a whole brigade, they crossed the high road between Rosberitz and Lipa unchecked by the Prussian fire from Rosberitz, and climbed the hill with a gallantry which only resulted in a fearful loss. The Prussian infantry detachments of the guard reserved their fire till the leading files were within a hundred yards of the weak line of less than five companies. Two well-directed volleys, and a withering file fire from the destructive needle-gun, brought the columns to a halt, and finally drove them

"across the high road in the direction of Langenhof." Two better instances could scarcely be found to show the very great necessity for teaching men to reserve their fire and save their ammunition. Much may be done by drilling men not to fire unless ordered, doing away with independent firing and substituting rapid volley firing, by word of command; but after all, in the heat of action, drill may be forgotten, and the true remedy appears to be to give the men plenty of practice, thorough acquaintance with and confidence in their weapon, so that they may know by experience that a shot unaimed is a round wasted, and that that round might save their lives later in the day. That practice does tend to the saving of ammunition, I know from experience. When I was conducting trials of the Martini-Henry last winter, I used to set the men to fire against each other, giving them a target each, and letting them fire for two minutes. New hands always devoted their energies to getting off as many shots as possible in the time, while the more experienced thought only of the aiming, with immense advantage in points when the targets were compared. Of course, in time they became able to combine rapidity with accuracy, but the best hands were too sharp ever to hurry an aim for the sake of getting off an extra round in the time, and the best results on the whole were produced by about 22 rounds in two minutes, at 500 yards.

Public opinion every now and then gets a fit of excitement about military matters, it seizes hold of one idea, insists on some one thing, is satisfied and goes to sleep again, fully convinced that that one thing being done all is secure. During the Prusso-Austrian War, the newspapers were full of sensation accounts of Prussians firing from the hip and mowing down hordes of their enemies at impossible distances; the needle-gun was the thing, why had not we the needle-gun? look at the way it had won all the battles in that campaign. Experiments were made: the British Army supplied with a breechloader, and public opinion was satisfied that it could, *therefore*, do all that the Prussian armies had done. Far be it from me to say that we should not have a good breechloader; it is evident on the face of it, that our very wealthy country, keeping a very small army, should supply it with the very best weapon that can be got; but even when we have it, and have men trained up to it, do not let us imagine that we have done everything necessary to ensure success to our forces. Campaigns will depend hereafter, as heretofore, on other things than the goodness of weapons, whether of artillery or infantry. First among these I would place discipline, on which all other things depend, the real basis of success, and which it is becoming somewhat the fashion of amateur army-reformers to undervalue and decry. Then power of marching—including the actual physique and walking power of the individual man—dress, food, hygiene, transport (rendered so much more difficult by the increased rapidity of fire), and last of all strategy, the art of manœuvring so as to bring large numbers to bear against smaller numbers.

The Chassepôt is superior to the needle-gun in range, accuracy, and trajectory, but it has not saved France; the Martini-Henry is undoubtedly superior to both, and as good as any other, but it will not win

campaigns by itself, nor will its goodness avail to set at nought the great military principles which have ensured victory in all ages.

Commander GILMORE, R.N.: May I say, as regards muzzle-stoppers, that some years ago I proposed to the Admiralty that, instead of using muzzle-stoppers as at present, an india-rubber capsule should be supplied, to go over the top of the rifle. It would perfectly exclude all air, and keep the barrel free from rust; and no danger would possibly accrue from the men firing them off by inadvertence.

Mr. CORNISH: I would say a few words upon this subject. The lecturer spoke of the Werder and the Tabatière rifles. I am the inventor of both those rifles. The Werder rifle is, I believe, about to be adopted into the Prussian service. The principle is precisely the same in every detail with the rifle which I brought forward here in 1866, under my own name, the Cornish rifle. The Tabatière was a compound of that rifle with the Snider extractor. I was put to very considerable expense by the French Government in the matter; and had it not been for this war I was to have had a sum voted at the commencement of this year. Colonel Fletcher, whom I see here, is acquainted with my arm. The principle of the extractor when produced was entirely new. It was a pivotted cam-lever, and the opening of the breech-block struck it and jerked the cartridge out. On several occasions I have put my claim forward in the newspapers, and it has never been denied; in fact the dates show it.

Major-General BOILEAU: Captain Drake made an observation with respect to the size of the Chassepôt bullet, which does not quite agree with measurements I have taken from a bullet brought from the field of battle by permission of the Prussian Government, and which with the cartridge was placed in my hand for measurement. I make the diameter of the bullet, at the top of the conical frustum, only $\cdot420$ of an inch, that is $\frac{1}{100}$ th less than the calibre of the rifle itself. At the base of the cone I make the diameter $\cdot464$ of an inch, and that of the small band at the bottom $\cdot470$ of an inch. These are small results with regard to the action of the bullet itself. I made the measurements carefully and critically, in case they should be mentioned here this evening. Those dimensions are different from what Captain Drake has given. I think Captain Drake also stated that the weight of the powder in the Chassepôt cartridge was the same as that in the Government bottle-shaped cartridge, 85 grains. I make it, by careful weighing, 81 grains. In fact, the Chassepôt cartridge complete weighs exactly the same as our bullet only, and the cartridge entire weighs only a little more than one-half what the cartridge does which we now use in the modified form in our small-bore rifles. It has occurred to me to suggest whether it would not be to our advantage if the weight of our bullet could be slightly diminished; instead of having a bullet weighing a troy ounce of 480 grains, whether it would not be sufficient for all military purposes and for purposes of accuracy, to reduce the weight of the bullet to the avoirdupois ounce of $437\frac{1}{2}$ grains. I have made several bullets of this weight, into some of which I have introduced a wooden plug for the purpose of balancing it; not introduced into the base, but introduced into the body of the bullet, to give it an exact balance. As far as I am able to judge from shooting in the Hythe position, I think the result has been an improvement in the accuracy. Probably a bullet of that kind would be too expensive to manufacture, therefore it might not be introduced into the Government arms. But I do think it would be of some advantage if we could reduce the weight of the bullet, say 40 grains, that is, bring it down from the troy ounce to the avoirdupois ounce, and reduce the charge of powder in the same proportion, from 85 to 80 grains. The alteration would be small, but still it would be an advantage to be able to put four or five more cartridges into the soldier's pouch. The form of the grooving in the barrel has been very much dwelt upon, as if the Martini-Henry rifle was superior to all others that have been tried. Now, with all deference to those who hold that opinion, I must say that my experience, which extends over a period of certainly not less than ten years, in respect to the form of the rifling, does not go with them. I think the form of rifling in the Martini-Henry barrel is very complicated, and it certainly is not true in principle. It has been occasionally observed that it does not matter much what the form of rifling is, whether you take the French grooving, or the gouge grooving of the Americans, or the Whitworth grooving,

or the Martini-Henry grooving, or the Boileau grooving,—that it does not matter as long as you get a good pitch twist and a clean barrel. But I think if it can be shown that there is an advantage in one form of grooving over another, it is likely to result in practice that the better form of grooving will give a better range and a better trajectory than the other. My experience is that my own form of grooving is quite equal to the Martini-Henry, as far as the results which it produces: and it has this advantage in it, that it has no sharp-edged angles in which dirt can accumulate, and which, therefore, foul the rifle. As the question here this evening is limited to the Government adopted patterns of England, France, and Prussia, I think it would not be right to enter into the question of other forms of rifling. But as the Snider is still one of the Government rifles, and as there is still a small-bore Snider which is in my experience equal to anything that has been made, I do not think I shall be out of order if I draw attention to a form of Snider-rifle made by Mr. Newark, the inventor, of which there is a sample in the racks of this Institution, the last of Mr. Newark's improvements being a rifle of .450 calibre with eight grooves on my pattern, with his improved Snider action, which he has placed in my hands for experiment, and which I hope, before long, to try carefully and critically, although what we have heard this evening prevents all possibility of objection, for I am bound to confess that the arm which has been, after so much pains and care, manufactured under the superintendence of a Committee, composed of men eminently qualified to enter dispassionately into the question, is as little open to objection as it is possible for a gun to be. I will only say that I wish and believe that this beautiful piece, in the hands of the best soldiers in the world, will, when it comes to be tried, prove, as it has been described to-night, to be the best piece in existence; still, if it should be found hereafter, without prejudicing the manufacture of that weapon on a large scale, that another rifle may be found equally efficient and equally durable in action, public opinion will bear with sufficient force upon the Government to induce them to allow a few of these rifles to be tried, and to be either proved or condemned on their merits.

Captain DRAKE: With regard to muzzle-stoppers, a muzzle-stopper over the muzzle instead of in the muzzle, as I understand, has been already introduced into the service by Colonel Dixon, the Superintendent of the Small Arms Factory. I was not aware that the Werder and the Tabatière were on the same principle. I confessed, I believe, that I have never seen the Werder. The measurements of the Chassepôt cartridge, both bullet and powder I did not take myself,—I am therefore quite prepared to yield to General Boileau's accurate measurement of them. The question of alteration in the weight of powder and lead, as regards the trajectory, was, I believe, carefully gone into by experiment, not only by this Committee but also by previous Committees on Small Arms, forming part of the Ordnance Select Committee. As regards the grooving of the barrel and the success of the shooting of the Henry barrel, I may merely say that I have been purposely this evening confining myself to the fact that I had before me the actual results of the shooting of the Henry barrel against all other systems which were brought against it into competition. My point has rather been that the Committee was in the first place a good Committee; and that, in the second place, the Committee had no option but to decide as it did decide. Whether another system will be found that will produce better results hereafter I am not prepared to state, until the system has had the same trial as the present system has. As regards the Enfield system, it was tried with a .45 bore, and the results were not so good as those obtained by the Henry barrel. The Henry barrel was first made with nine grooves, then with seven, and the seven has beaten the nine. The Newark-Snider I have not seen as a small-bore. I have seen the large-bore in the armoury of this Institution; I have not carefully examined it, therefore I should not like to give an opinion of it. The present Snider differs materially from that, and I would point out that the complication is on the side of the Snider and not on the side of the Martini; there are far more parts in the Snider action than there is in the Martini, that is, in the Government Snider.

The CHAIRMAN: I think that what we have heard from Captain Drake, who is so well able to give us the details of all that has taken place, must convince us that the question of the best rifle for the Army has been most elaborately and

carefully considered. I am sure the country is indebted to the Committee, or rather Committees, presided over by Colonel Fletcher, who have gone very carefully and with great impartiality into the whole question. I cannot help thinking that the time has now arrived,—whatever may happen in the future, whether a better rifle may be invented or not,—for the whole Army to be armed with the weapon which has successfully undergone so severe a test. I will conclude by expressing your thanks, which I am sure you will authorise me to do, to Captain Drake for his very elaborate and valuable paper.

LECTURE.

Friday, April 21st, 1871.

GENERAL SIR WILLIAM J. CODRINGTON, G.C.B., in the Chair.

A VISIT TO SOME OF THE BATTLE FIELDS AND AMBULANCES OF THE NORTH OF FRANCE.

By Surgeon-Major F. J. MOUT, M.D., F.R.C.S., &c., &c.

In the year 1851—within a few days of the date on which we are here assembled—the late Prince Consort, a man far in advance of the time in which he lived, hoped that the friendly rivalry of nations inaugurated by the first of the Great International Industrial Exhibitions, would mark an era of peace and good will among men, and that the national contests of the future would rather be in arts than in arms.

At that time the peace of Europe had not been seriously disturbed for more than a third of a century, and there was good ground for the hope expressed.

Yet, the world has since witnessed in the compass of a single generation, the greatest and most terrible contests that have ever occurred in the history of the “madness of nations.”

The Crimean War, the Sepoy Revolt in India, the great American Civil War, still unexampled in extent, the campaigns in Italy and Mexico, the Danish War, the internecine German contest of 1866, and the great military drama enacted at our very door, upon the last act of which the curtain has not yet fallen, have probably caused a greater waste of human life, and produced a larger amount of human suffering than are contained in the compass of any single century in the whole range of authentic history.

Of all the contests referred to, none has excited so large an amount of coteremporaneous sympathy and interest as the Franco-German War.

The reason of this is plain, and on the surface.

For the first time, the two greatest military powers of the Continent were about to measure swords on apparently equal terms. Both were believed long to have prepared for the strife, and each was known to have wished for it, however strenuous their subsequent denials have been.

Both were our friends. France, after a rivalry of centuries, had become united to us in the bonds of amity by the baptism of blood and the fellowship of the battle field. With Germany we had been associated in many a hard fought field. We were of the same Teutonic stock, and the thoroughness of the great German nation in every department of human action, had acquired the strong regard of all reflecting Englishmen. The alliances of our own Royal Family with some of the leaders of the German hosts, were not without their influence on all loyal subjects of the Crown.

Again, the mighty instruments of destruction which some hoped would put an end to war by the very completeness of their powers, were about to be subjected to practical proof in the hands of brave, trained, and skilled warriors.

The arts of peace in their application to the purposes of war altogether changed its character. The railroad and the telegraph did the work of weeks and months in a smaller number of hours and days, and brought hosts into the field complete in arms and equipment, to an extent impossible in the contests of even the early part of the century.

But, chief among the causes of the intense and all-absorbing interest in the strife, was the marvellous action of the English press, whose "war correspondents," braving the perils of the campaign, exposing themselves freely to the dangers of the field, and writing with a force, vigour, and fidelity heretofore only found in the study of the historian, spread the news of the great events over the face of the civilised world with a rapidity that is truly astonishing, even in this age of the triumphs of science in its application to art.

Almost before the smoke had cleared away from the battle field, and the echoes of the cannon and mitrailleuses had become inaudible, and certainly before the groans of the wounded had lapsed into the silence of the sleep that knows no waking, and the harvest of dead had been garnered in the grave, each struggle and its issue was made known to the millions of anxious and expectant readers from hour to hour and day to day.

Even in the far distant East, many thousand miles away, where I was during the early period of the war, I knew of the chief and most exciting incidents within a few hours of their occurrence.

Another feature of special interest connected with this war, was the working of the Geneva Convention, under the provisions of which neutral nations were enabled, without taking an active part in the actual strife, to mitigate the miseries, and pour oil on the wounds of the disabled combatants of both armies with the strictest impartiality.

It was chiefly with a view to see and judge for myself of the results of this mission of mercy, that I accepted an invitation from Sir Vincent Eyre late in February, to accompany him on a tour he was then about to make through some of the districts of the north of France, which had been the scene of great military operations.

What the nature of the Geneva Convention is I dare say you all know, from the instructive account given of it by Professor Longmore in this theatre a few years since; from the large amount of space

that aid to the sick and wounded in the war has occupied in the published correspondence of the time; and from the clear view of the operations conducted under his able and zealous guidance, detailed a few days since by Colonel Loyd Lindsay.

But, before proceeding to the immediate consideration of the subject which has brought you here to-day, I must guard myself from any intention of giving offence to the sympathies of any persons present on the one side or the other.

It is impossible altogether to avoid a feeling of preference for one party or another, even in reading of the great events of past times. This sentimental view of human actions extends even to the perusal of the great master works of fiction: how much stronger then must be the feelings of the standers-by in a great contest in which so many and such varied interests were involved?

A few years ago, I was travelling from Drogheda to some dear and valued friends in that vicinity, and passed for the first time over the field of the battle of the Boyne. I asked the carman driving me to point out the chief features of interest in the scene, and to give me some account of a battle which still lives in song and story.

The carman looked at me as only an Irish carman *can* look, and said, "Will your honour first tell me which side you are?"

"Why do you ask, Paddy?" was my reply.

"Because," quoth he, "a short time ago I was driving a Saxon gentleman over the ground, and I gave *him* the wrong side, and he gave *me* a thrashing."

"Well, then, give me both sides," I said, and I thereupon listened to the most amusing history of a great battle that I have ever heard.

I will do by you just as Paddy did by me—I will give you both sides, with as much impartiality as I can command; and this, I believe, will be the strict neutrality that was expected and demanded from us.

Well, then, I accepted the invitation of Sir Vincent Eyre to accompany him in his visitation of the chief ambulances in his circle of supervision.

General Eyre originated a movement to afford aid to the sick and wounded in the north of France, and subsequently directed its action in subordination to Colonel Loyd-Lindsay's Committee.

The names of Sir Vincent and Lady Eyre, of Colonel and Mrs. Cox, of Colonel Berington, Captain Uniacke, Lady Pigott, Drs. Leslie, Goodenough, and Lloyd have become household words in the districts in which they all laboured with such untiring zeal, humanity, and success.

We started from Boulogne, General Eyre, Monsieur Valliant, his able and excellent Secretary, and myself, on the 28th of February. At the station there was an absence of the usual life and animation of that great resort of English travellers. Armed sentinels paced the platform to prevent the escape of the poor Mobiles, who seemed to have little stomach for fighting their formidable foes.

We first saw the spiked helmet, which is now historical, on the distant bank of the Somme, and thence to Amiens every station was in possession of a German guard.

Here and there we saw indications of strife in large ragged holes in the walls, partially dismantled roofs, small railway bridges blown up and temporarily restored with planking, and similar results of the tide of battle which had swept along this great line of communication. The surrounding country seemed to be unusually still and lifeless.

On reaching Amiens, that well-known resort of English travellers, the station was scarcely recognizable. The buffet was closed, the noisy newsvendors had disappeared, and their place was occupied by a strong German guard. German Officers strolled and chatted along the platform, which was evidently the Mall of the moment, the place of daily congregation for news. In one of the sidings was a heavy train of Prussian hussars with their horses. On another was a portion of the *Sanitäts Zug*.^{*} The arrangements of all were admirable, and exhibited the marvellous attention to details which has been one of the chief causes of the nearly unbroken successes of the German arms.

On entering the town it was painfully evident that the hand of affliction pressed heavily on the gay capital of Picardy. The streets were silent and half deserted, the shops were only partially open, nearly every house was scored by the universal chalk indicating the number of unwelcome guests lodged in each.

At the Hotel du Rhin we experienced our first taste of the German occupation. All the best rooms had been requisitioned, and we obtained with difficulty three wretched apartments, bearing unmistakable evidence of careless and destructive occupation. Along the corridors sauntered stalwart, well-fed, good-natured looking German soldiers, attendant upon their Officers, all in such good case as to show

^{*} The *Sanitäts Zug* was the most complete thing of the kind I have ever seen. It was a train for the transport of sick and wounded, containing within itself all the means and appliances for their feeding, dressing, and treatment in transit. The carriages all intercommunicated by a central passage. The kitchen, dispensary, store-room, quarters for the staff in attendance, and baggage train were in the centre, and most ingeniously arranged so as to secure the largest amount of accommodation in the smallest space. All was so carefully and judiciously disposed, that any article required, whether of food, physic, clothing, or surgical appliances, could at once be produced for use on the most emergent demand.

The carriages for the sick and wounded contained separate sleeping bunks, placed longitudinally, and supported by various devices (india rubber springs, coiled wires, &c.) to diminish all jarring and shaking such as would prevent the union of fractured bones, or cause suffering and uneasiness to those to whom the least movement would be attended with pain.

The central passage was sufficient to allow of wounds being dressed, apparatus removed and replaced, and medicine being administered, &c., without the removal of the patient.

How far it fulfilled all its intentions I did not learn, but on two occasions I saw such a train halting at Amiens outside the station, and crowded with men with heads bandaged, arms in slings, and showing other indications of convalescence from wounds and diseases, basking in the sunshine on the little inter-communicating platforms, smoking the universal pipe, and looking cheerful and happy—as well they might, for they were on their way to their homes in Germany, to tell the story of their great exploits on the fields of fair France.

Such trains seem to me to be well suited for immediate introduction in India, where large bodies of invalids are annually transported to the hills, or to ports of embarkation, and where the railways are, to a certain extent, subject to the control of the State.

little indication of the rough handling of grim war. The usual amenities of hotel life in France were conspicuous by their absence.

Our first visit was to the stores in the Rue Lemercier, under the charge of Colonel and Mrs. Cox, with the Red Cross flag flying over the gate alongside of the Union Jack.

The stores had diminished very considerably in amount, in consequence of the great and constant drain upon them by the great battles fought on the plains of Picardy. I will not trouble you, in so slight a sketch as mine is intended to be, with any detailed figures, but the report of General Eyre on the table shows that in one month some 20,000 wounded received assistance; in the month succeeding, some 14,000; and that to the date of our visit large numbers of sick and wounded had continued to be succoured.

Timely relief had also been sent to some distant fields, and Le Mans, Tours, and other scenes of sanguinary encounters had shared in the priceless benefits of the *Société Nationale Anglaise*.

At the great battle of Querieux, fought in the immediate neighbourhood of Amiens, the ambulance of Colonel Cox and Captain Uniacke was early in the field, and received the cordial acknowledgments of both belligerents for the efficient aid rendered to each in the hour of need on this and on several other occasions.

We were at Amiens during the armistice, by which time most of the hopeless cases had succumbed, and those less severely injured had been discharged or removed elsewhere; the greater number of the ambulances had ceased in consequence to be occupied.

The largest ambulance then in effective operation was that of the Prussians in the Musée Napoleon. This is an extremely fine modern building, in part a picture gallery, and partly a museum for curiosities of art and science of all sorts and descriptions. Most of the cases had been emptied of their valuable contents, the pictures still hung on the walls, and between them were double lines of rough wooden cots, raised high for the convenience of the doctors and nurses rather than for the comfort of the sick, which should be the primary object of all such arrangements. The wards were well filled, but not overcrowded, and there was but one dying man in them—a delicate fair haired German lad, with the hectic flush of approaching dissolution.

We had scarcely entered the building when a young lady approached us, followed by a henchman bearing on his arm a basket laden with cigars. She announced herself as Clara Heinritz of Berlin, and undertook to conduct us over the building to show us the good work which had been done. She most obligingly bid us not to be afraid, as there was no contagious disease within the walls! The only contagion we witnessed was the reflection of happy contentment that passed across each suffering face, as her cheerful greeting was given to all she passed.

It was singular to watch their countenances as we went round. A few of them spoke French, probably inhabitants of the counties bordering on the Rhine, or men who had passed a portion of their lives in France. I asked one of them why the sheets which had been placed over the Ettyan pictures of nymphs, naiads, and classical ladies of the

same order, had been removed in some cases and not in others, for I suspected that our prudent friend Fraulein Clara had an objection to these amenities of modern French art being exposed to the gaze of the sick soldiers.

The man said, "As soon as we get a little better we lift up a corner of the sheet to see what is beneath, and as we get better still we raise the other corner, until ultimately the whole veil is rent asunder, and is not again replaced!"

The impression I formed of the place was that the air was close, oppressive, and unwholesome from insufficient ventilation, and that those in charge of the sick do not rely as much as English surgeons on good feeding, and the stimulation necessary to ward off the depressing effects of injuries received on the field of battle, or of the diseases acquired in crowded hospitals when the excitement of active participation in the work of war is summarily checked in men in the prime of life. The men looked pale, colourless, and dejected, contrasting strongly with the happy, cheerful looks of many far more seriously injured French soldiers whom I afterwards saw at Lady Pigott's ambulance in St. Quentin.

The state of the sick was not due to a want of the means of ministering to their physical wants, or to a deficiency of creature comforts, for the earnest and amiable Fraulein supplemented our visit to the hospital by an examination of her stores at the Prefecture close by.

Here, at this advanced stage of the war, was gathered together a surprising stock of material of all kinds for dressing wounds, clothing and feeding the naked and hungry, and warding off evil consequences of all kinds. Among them were 300 dozen of port wine of superior quality, and yet, with all this unconsumed material at their command, and fifty tons more at the railway station, the German doctors had obtained supplies from the hard-pressed and impoverished English stores near at hand.

It was most manifest that Germany had neglected nothing in this great contest, and could have needed little external aid of a material description for her soldiers.

There were other interesting ambulances in the town at the time, but as they were nearly or entirely evacuated, I will not trespass on your patience by describing them.

And now occurs a question which has been much discussed, and on which some diversity of opinion exists. It is, what is woman's place in war, or, as some suppose, is she not altogether out of place in approaching scenes of strife, and becoming witness of its horrors.

I think not, and had I entertained any misgivings previously, they would have been entirely removed by what I saw and heard in my visit to the north of France.

When man has done his worst, and, with the instruments of destruction now employed, has piled up an accumulation of mutilation and suffering, the bare recital of which is sufficient to freeze the blood, then is it woman's mission to step in, and by her gentle, patient, loving, self-denying influence to mitigate, so far as they are susceptible of mitigation, the miseries which are inseparable from war in every form.

We have heard a good deal lately of woman's rights, and there has been not a little of vain and idle talk on the subject. Let us now see something of woman's work—work which is foreign to man's nature, and which he is quite incapable of performing, however anxious he may be to do good to suffering humanity.

In such a matter I would rather put before you the evidence of an earnest and successful worker than any views of my own.

The lady in charge of the Amiens ambulance is Mrs. Cox, the wife of a distinguished British Officer. She was trained to hospital work in the Crimea, in association with Florence Nightingale. No better guarantee of her thoroughness could be afforded.

Sir Vincent Eyre has kindly placed at my disposal a number of Mrs. Cox's letters addressed to Lady Eyre. They were written in the still hours of the night after the serious and responsible labours of each day were concluded.

I will read you extracts only from those of three consecutive days. Multiply these by many months, several of them of an almost arctic winter, and you will be able to form some faint idea of the great amount of good accomplished.

“ November 7, 1870.

“ Yesterday was a busy day. After early morning prayers we set to work packing for Orleans—the results you know. Many of the worst cases I visited yesterday at two hospitals. Mr. Leslie saw the wounded prisoners: in all cases he orders feeding constantly in small quantities. I follow him with my baskets, and at once give the directions for the hour. By that time the sisters discover the benefit to the patients, and all that remains for us is to keep up the supply in *small* quantities. If abundant, it is emptied into the potage. We begin to discover that in many cases the mind is more afflicted than the body: they study the faces of doctors and nurses; in too many cases the latter are easily frightened. The screen (a death warrant a sick man imagines) is placed round the bed, so that his comrades may not see him die—a little food is administered—the priest arrives, and all is over—so the sufferer thinks. In a few cases, Mr. Leslie, after examining the wounds, sees no reason why the man should not live. Wine, jelly, &c., are given, and in a very few days we find the man sitting by the fire; but we never lose sight of him. You should see how anxiously they look round the screen for our arrival.

“ One of the condemned ones on recovering looked very miserable. I asked the reason. ‘I am better,’ was the reply, ‘but I can’t get up.’ ‘Why not?’ ‘Because I have no clothes—no pantaloons, no coat, no socks, no shoes—nothing.’

“ ‘Donnez-moi vos ordres, Monsieur; je suis tailleur pour le moment—England will be proud to dress a French soldier.’

“ It was 7 p.m. Two sisters followed me at 8. We made up his bundle according to the order, and they gave it to him. He would scarcely give them time to dress his wounds next morning, so anxious was he to be dressed. They gave him a pair of crutches, and when I reached the hospital at 3 p.m. to cook a few messes for some very sick, he was then at the fire ready to stir the chocolate, and so happy! I am told on all sides that no words can express their gratitude—they can only cry their thanks, they are so weak. I have just seen a sister from the Grand Séminaire who dresses the wounds, and she tells me they can only talk of England's bounty and sympathy.”

* * * * *

“ I had to meet a deputation of sisters to-day, who all wanted to make my acquaintance. Would I only come to see them and their work? I requested each to send me a memo. of her dwelling and her wants, and I would take them all they required. This sort of hospital visiting is not fatiguing, as I have only to make

myself pleasant to the sufferers: they are all so gentle and quiet—it is no great effort.

"I tell you only hospital news, as I never think or talk of anything else. One feels that one can be of use; and then one is so fond of one's Queen and country when one hears all the blessings showered on both by men of another country and language."

"November 9.

"Of all the busy days I ever had, this has been the busiest—without one moment unoccupied.

"From 8 a.m. until 12.15 in the store-rooms, receiving the sisters and brothers who escort the soldiers in parties to the trains. Those who have not received the warm clothing previously, provided there is a necessity, we dress on the spot. They then have their little bags for the journey, in which they place a packet of tobacco, a piece of soap, a piece of lard, another of cheese, a flannel bandage for their wounds, bundles of old linen and charpie, a small medicine bottle of wine or brandy, two or three biscuits, according to size. Their gratitude and pleasure know no bounds. They were being discharged from hospital yesterday—I should say had their papers, but slept there last night. The serjeants in charge of them told me that they spent the whole of the evening in singing songs, and giving cheers in their odd way for England!"

She met with obstructions in her work chiefly from the selfishness of the authorities, and the blind adherence to injudicious rule of the ministerial authorities. This is how she dealt with them—

"—is furious, and told me in confidence I was the only person she could trust—even the sisters are her enemies. No wonder, I thought. I think she finds I am as firm as herself. She told me to say I could not see the sick, as the entrance was cloistered. 'That is nonsense, my sister, and if I cannot enter I shall carry away all my things. I will not leave a thing. I came for the purpose of giving the 30 men in their beds a good supper: if they do not get it the fault is yours.'

"'Would I not leave the things?'

"'Certainement non, ma sœur; I am here to bestow England's bounty, and no one else shall give it; je reviendrai demain, adieu!'

"'Mais Madame, si vous voulez monter le petit escalier,' &c., &c.

"She then put her arm in mine, and off we trotted. Each man had his essence of beef, jelly, and glass of wine. Methinks they will sleep well on it. Thus we parted and—hoped I should return soon."

In the same letter she says—

"It is quite useless giving the Nightingales: the men retain them three or four days, and then they are told they are too hot or too cold—they disappear, and I can't hear of them again, so I am turning them all into shirts. I gave one hour to a deputation at the house of the Count de la Motte. They asked for work. I gave them this—cutting out and fitting one with a lady who cuts out well. One Nightingale makes the body complete, one double flannel bandage makes one pair of sleeves, and then a piece of scarlet flannel (a strip) makes the collar and cuffs. In this way I shall add to the number of shirts, for which there is an increasing demand.

"An Officer arrived here yesterday from Metz nearly naked, without anything except what he stood in, and no money, minus an arm. His arm was shot clean off, but the doctor amputated it again close to the shoulder. He did it with his pocket knife and a kitchen saw—no chloroform. The officer sat the whole time looking on, smoking and helping the doctor. He is to have a command here—he looks a lion, and yet is so pleasant.

"An Officer, very ill from his wounds at the Prefecture, has been lying on his back for two months, and is getting bed sores. To-day I took him a water pillow. At the sight he exclaimed, 'Ah, Madame, vous voulez me sauver.' 'J'espère qu'oui,' was the reply. I filled it with the aid of a sister, and then he insisted no one else should place it. Such a work to move him. However, I settled him entirely to his satisfaction,

left him the custard pudding we had made, together with a bottle of the best port wine. As I was about to leave he exclaimed, 'You say I must eat, but I can't. I don't like what the scours make—they spoil the good English things. You made me such nice arrowroot cream on Sunday, and they have tried every day since and only spoilt it.' So to-morrow I promise to go down and make it myself.

"He says that pillow will save his life. Poor fellow, he suffers so sadly and frets himself to death because he cannot go and fight the Prussians: it is his one continuous cry. Such scenes as I witness every day make me very sad! but really there are times when, if I dared, I could laugh heartily, officers and men, all alike, are so like spoilt children. Their expressions of wonder as to how it was possible the English should know their wants so well, for they have only to express a wish and it is gratified. 'Well, there is no other country in the world so generous and so considerate.' Then those good, patient, devoted sisters are as much surprised as the men, but generally add, 'Mais, Madame, you must teach us how to use all those good things.' Making the arrowroot is quite beyond their capacity. However, each hospital must have another lesson.

"When the sisters are cheerful, the men gain strength rapidly. Day after day as I go my rounds, I am forcibly struck, especially as I now begin to recognise the men's faces and seem to have made their acquaintance. To-night I noticed a marked difference in many of the men since I have fed them so liberally with the essence of beef—one thin slice is the allowance for 24 hours. The scours object, as they say it is better to put it into the soup, but they begin to find that arguments are vain, as I tell them my time and theirs is far too precious to be wasted thus."

"Thursday, November 10th.

"I was just starting to make the arrowroot for the very sick at the Prefecture, when the head sister arrived to tell me that my friend on the water pillow (under his back) had slept better last night than he had done for two months, that he was hungry and wanted the arrowroot *à la crème* (mixed with the yolk of an egg) we made, and off she started with a basket containing it, and some magnificent pears which had been sent to me for my children, but too much wanted here to spare them, a fresh egg, and other little dainties for the very sick.

"While I was over the kitchen fire cooking, the Prefect arrived to thank us for what we are doing for the sick: he is a most agreeable, kind person.

"How can I express my joy—I may almost say gratitude, at the sound of the many nice things coming to-day. Three water-beds! was there ever such a gift. Only yesterday an Officer told me, as I was placing the water pillows, 'The Empress sent a water-bed to one for our Generals, and I saw the comfort of it, but knowing the expense and difficulty of obtaining one, I never dreamt it possible that I could even get a pillow, as these are only gifts given by Royalty.' To-night, when I get the bed and take it to him, I mean to tell him that our beloved Queen has helped to send water-beds to the suffering French. Last night myself and my most useful little servant had devised a double flannel case, in which I meant to place two water-pillows, and thus make it large enough. To-day comes the invoice of three beds!

"The Prefect expressed his warmest gratitude to the English, and especially to our Sovereign and to the ladies of England, for their noble deeds of Christian charity."

In the same letter there is much more that would interest you greatly, but as it contains the views of the writer on passing events, it would not be right to reproduce them without her sanction, but one little passage I must give you, with a slight verbal alteration, as it is a striking commentary on the Red Republican rubbish which has recently found expression in London:—

"Seeing France passing through this terrible crisis, watching day by day how her rulers are tossed hither and thither, not knowing how to act, where to go, or how to resist the armies which march with bold effrontery throughout the length and breadth of their land, makes me thankful that we are governed as we are, and have such a bond of union as we possess in our Queen."

" November 12th.

"To-day busy as usual; to-night Colonel Cox worked until dark, himself piling the boxes on the carts. I cannot tell you how amused I am to see all the gentlemen here packing and hoisting all the boxes in and out of the waggons as though they were part and parcel of Pickford's machine; they will not have any help more than is absolutely necessary. We have an invaluable Joseph, who is found to work like his employers, so nothing lags here. However hard they may have worked with their heads, of this I am sure, they never before tried manual labour as they have here. Never a grumble, never a hard word, all goes on so quietly and smoothly. In the boxes packed here to-day, we filled all the spare corners with flannel, cocoa, corn-flour, Liebig's essence, &c. I took out all the straw, as I thought there was plenty of that to be had anywhere."

All this cheery, kindly, graphic, womanly gossip you must remember was not intended for the public eye: it was merely to record the daily work of one branch of the National Aid Society for the information of the central authority.

In my humble judgment there are no pictures in the most exteemed of our works of fiction that surpass these photographic sketches of war behind the curtain in pathos and interest.

They answer, more completely than I could hope to do by any words of my own, the enquiry as to woman's place and woman's work in war.

If time permitted I have more to tell you about Amiens, but I must get on, as I have still a good deal of ground to cover.

On the morning of our departure there was considerable excitement to learn the particulars of the entry of the Germans into Paris, regarding which some wonderful fictions were narrated by eye-witnesses—so difficult does it seem to be to obtain accurate accounts of the most recent occurrences.

We started on our way to Tergnier at early dawn, and along the line were frequent evidences of conflicts—the most noteworthy of which were long mounds of fresh earth as yet destitute of vegetation, with small wooden crosses at the head, indicating the spots where the weary were at rest, and those who had engaged in mortal strife above lay in peaceful neutrality beneath.

At Tergnier we were detained an hour and a-half for the Paris train to Lille and Brussels, which was to carry us to St. Quentin.

The waiting-room of the station was fitted up as an ambulance to rest those sick and wounded soldiers who needed to break their journey home. The arrangements for their comfort were excellent, and were supplemented by an ample store of restoratives and all needful means and appliances, under the charge of Hans Lutze von Wormb, an accomplished and courteous gentleman, who explained his arrangements to us, and did the honours of his charge with much kindness and consideration.

While on the platform a fine looking man, in the uniform of a German railway official enquired for Colonel Cox, and made known to that Officer the deep obligations under which he, and those of his countrymen who had been prisoners at Calais, were towards Mrs. Cox. He spoke most feelingly of her unceasing attentions and judicious care, declaring that the sunshine of her presence alone dispelled the cold and

wearisome monotony of their gloomy captivity. He was about to return to his home in Westphalia, where he should not fail to make known to his countrymen the kindness of the good English lady, which could never be effaced from their memories.

I forgot to mention to you that while waiting at Amiens for the Paris train, a stalwart, well-knit young fusilier of the Prussian Guards, in full marching order, went up to the Correspondent of the "Daily Telegraph," saluted him, and thanked him in simple eloquence for having saved his life. The gallant Officer in question, who has sustained the fame of his country on several hard-fought fields by freely risking his life in bringing the badly wounded from under a heavy fire, had apparently forgotten the man and the circumstance.

"You evidently do not remember me," said the grateful soldier, "but how can I ever forget the countenance of the kind and brave gentleman who found me suffering and dying in a ditch, and placed me in safety? I have now recovered, and am about to rejoin my regiment, and should I survive the campaign, to the end of my days shall I bless my preserver, and make known to my countrymen how, at great risk to himself, he saved me from a lingering and dreadful death."

With that, his face trembling with emotion, he saluted, faced about, and marched to his place in the railway train.

Such traits as these redeem war from much of its cruelty and barbarism, and will be held in grateful memory long after the angry passions of the contest have passed away.

My fellow travellers had dispersed in different directions, and I was left alone in the refreshment room with a sad, aged looking man sitting silently by the fire.

He looked cautiously around, with the suspicion that seems to have pervaded the whole of France in this unhappy war, and finding we were alone, asked, in an anxious whisper, the news from Paris.

I told him all I knew, when he said that he had been present on the occasion of the entry of the Allies in 1815, and denounced Paris emphatically as the curse of France, and the cause of all her miseries.

We were told by Graf Sierstopft, the chief of the German ambulances in the north of France, that the peasantry universally, and the inhabitants of the smaller towns generally, were equally loud in their condemnation of the capital, and complained that the Germans had not punished it sufficiently. They only wished to live in peace and quietness, and, if the destruction of Paris were needed for the permanent repose of France, wished it to be destroyed.

It is curious to read the opinions of eminent Frenchmen regarding Paris, by the light of recent events, when its destruction by the ruthless Reds appears to be a probable contingency.

A century and a-half ago (in 1775) Retif de la Bretonneau regarded Paris as the centre of the unrestrained licence of France, and even then as the "mauvais lieu" of Europe.

Jean Jacques Rousseau, a century since, wrote that "it is inconceivable that, in this calculating age, there is not a single Frenchman who sees that France would be more powerful if Paris were effaced."

Monsieur Thiers, the chief of the executive Government of France, whose splendidly mendacious romance of the Consulate and Empire has probably had more to do than is generally supposed with the present unhappy condition of his country, wrote thus of Paris in 1840:—

“Our beautiful country enjoys an immense advantage, it is ONE. In it thirty-four millions of men, upon a soil of moderate extent, live the same life, feel, think, and say the same thing at the same moment. It only enjoys this advantage by the existence of a single centre, from which the common impulse, which moves all, emanates. It is PARIS, which speaks by the press, which commands by the telegraph. Strike this centre, and France is like a man struck on the head (stunned).”

It is somewhat singular that it has been reserved for M. Thiers to strike this blow. A lingering belief in his own faith in Paris may possibly have exercised some influence on the temporizing policy by which he has heretofore hoped to reduce, without destroying it.

Victor Hugo has said that “Paris is not a city: it is a government. Whoever you are, behold your master.”

Louis Blanc considers that one who “has not passed an evening in Paris” knows not life—has not lived.

M. Jules Simon, a member of the Government of Defence, and now a colleague of M. Thiers, wrote some years since as follows:—“Some days since I accompanied to the Buttes de Chaumont an illustrious statesman, with whose friendship I am honoured—Mr. Gladstone. In presence of the grand spectacle of Paris spread beneath our eyes, he made this very English remark—‘There is not enough of “smoke.”’

The illustrious Premier would not be of that opinion now could he again look upon the fair city, deluged with blood and in course of destruction by the hands of her own sacrilegious children, with tall chimneys sending forth the smoke of furnaces forging the instruments of her ruin.

Stahl said that “In times of revolution it is Paris which is sick, and the country which sighs;” and again, that “A sleeping cat must not be awoke. This is the true policy of all governments in regard to Paris. Happily Paris always sleeps with one eye open.”

The well-known political writer, Joseph de Maistre, declared that it was not in human art to govern Paris, “Car c’est le diable qui le mène.”

We reached St. Quentin a little after mid-day. It was full of German troops, and had several ambulances in full and effective operation; in addition to this, it is an interesting and picturesque place.

The ambulances at St. Quentin were organized by M. Lebé, a local manufacturer, who had evidently worked them with indefatigable zeal and remarkable success. That in his own factory was still full of wounded men, was clean, fairly ventilated, and all the cases were doing well. The patients were cheerful and contented. Many of them had been very seriously injured, and owed their lives and limbs to the care and comforts of the ambulance. All were anxious that I should examine their wounds, and were thankful for a

few words of kindness and sympathy. They spoke modestly of the part they had taken in the battles of that vicinity, and attributed their defeat greatly to the want of skill and experience of the subaltern officers, and to the state of starvation and unsuitable protection against the weather in which they were led to battle.

In addition to a small, well-regulated Belgian ambulance, and a few sick in a private house attended by the Dames de la Croix, was Lady Pigott's ambulance, in a warehouse opposite to the railway station. I wish the time allowed permitted me to describe it in detail, for it was a model of what such places should be in cleanliness, comfort, unwearied attention to the sick, excellent ventilation, and the most perfect devotion to their great and good work on the part of Lady Pigott, the surgeon of the establishment and his wife, a lady assistant, a Parsee dresser from Bombay, and an indefatigable cook, a direct lineal descendant of a celebrated poet. We carried away the most pleasing recollections of the place, and I would fain hope that Lady Pigott herself will give us some account of her experiences during the late war, from Gravelotte and Metz to the close of her labours at St. Quentin.

Before leaving St. Quentin, we assisted at a grand military parade in the place, and were much struck by the perfection of the military machine which has changed the face of Europe, and given altogether a new character to war.

From St. Quentin to Peronne the route was through the beautiful country of Picardy. At every step were traces of the great struggle—chiefly in the shape of melancholy mounds marked by wooden crosses, each of which told its own sad tale.

We halted half way at the village of Tertri, embosomed in undulating hills and surrounded by fertile fields making ready for the seed which was to come from England.

We first called on the Maire, a good specimen of the sober, stolid peasant proprietor of Picardy, who was engaged at that moment in ministering to the material wants of the German guests quartered on him—all evidently famous trenchermen of the Dalgetty type, who laid in at each meal provender for a short campaign. They were gobbling and grunting over their meal with an earnest devotion that barely admitted of their responding to our inquiry that it was "zehr gut."

The maire's daughter, a tall, bright comely maiden, gave us a graphic account of the battle fought close to the windows of the farmhouse, which appeared to have been chiefly an artillery engagement, followed by a magnificent charge of cavalry in pursuit.

To our inquiry as to the general behaviour of the German soldiery, she described them as peaceable, well-disposed, and considerate in the main, except as to their capacity for victualling. But, "were they otherwise," she added, with a laughing, resolute eye, and a grand toss of her fair head, "I should know how to keep them in order."

She conducted us to the house of the curé, who had still one Mobile minus a leg, under his hospitable roof. The good churchman also told us how the tide of battle ebbed and flowed round the village, and how

utterly overwhelmed they were by the rapid accumulation of wounded and dying in every cottage of the hamlet.

He was much touched by the kindness of the strangers who came from afar to relieve their sufferings, spoke earnestly of the heavy pressure of the German requisitions, and how he had himself been utterly worn out and prostrated by three consecutive days of toil, and had then sought his bed to recruit exhausted nature.

"Alas!" he said, "there was no bedding; blankets and everything had been removed, except an old dilapidated pailasse, and even that would probably have disappeared had they foreseen how soft and sweet would be the slumber it afforded to my cold and weary frame."

We reached Peronne shortly after mid-day. At a distance, the tall tower of its Gothic church stood out in bold relief against the sky, and its lofty walls seemed to be uninjured. On approaching nearer, the trees bordering the road had been cut down, and a few cottages had been levelled, but there were no other indications of the siege.

Within the walls was the most complete scene of wreck and destruction it is possible to imagine. But two houses were uninjured; the rest were either shapeless heaps of rubbish, tottering shells of walls, or rift and torn as if by a mighty earthquake.

The church tower had been the target, and around it were all that the town contained of wealth and comfort in its habitations. The bombardment, which lasted for fourteen days, at length compelled the fever-stricken inhabitants to press the Commandant to surrender. The fortifications, guns, and works generally were uninjured; scarcely a soldier was hurt; the entire destruction fell upon the peaceful non-combatants. When the siege commenced, the hospital contained a large number of sick, chiefly cases of small-pox and typhus fever. It was utterly destroyed by the shelling, but every inmate was removed to a place of safety by those in charge of them.

Those of you who are acquainted with Quentin Durward—and who is not?—will remember the interest which attaches to the castle of Peronne, from the picture painted by the great master of fiction, of Louis XI, the Duke of Burgundy, and the troubles of that time of rapine and disorder.

We wandered through the castle to the ramparts, and looked upon the plain, the meadows, and the moat beneath. The Germans of the Guard were busy in their customary devotion to the Commissariat, and we had leisure to see how entirely the fortress was spared and the town was battered.

All this reminds us of another siege of Peronne, of a different character.

It was first taken by the Duke of Wellington, in his advance to Paris in 1815, up to which time it bore the name of Peronne la Pucelle.

All that relates to England's greatest soldier must ever be of interest to his countrymen. I make no apology, therefore, for reading to you his dispatch on the storming of Peronne, as it is contained in a few words:—

"I attacked Peronne with the 1st Brigade of Guards, under Major-General Maitland, on the 26th [of June, 1815], in the afternoon. The troops took the horn work, which covers the suburb on the left bank of the Somme, by storm, and the town immediately afterwards surrendered, on condition that the garrison should lay down their arms, and be allowed to return to their homes."

It is impossible to avoid comparing these two sieges of Peronne, as historical parallels are often of great use in judging of cotemporaneous events.

The Duke of Wellington, abiding by the ordinary usages of civilized warfare, confined his attack to the works and their defences—in fact, did his work like a true and high-minded soldier.

General von Goeben is also a great soldier, and may possibly have been guided by strategic considerations connected partly with the rigorous season in which his attack was made.

Yet, the fact remains that Wellington with the inferior weapons of the time and the small force at his command, took the place by assault in the course of a single afternoon, while the German General, with all the means and appliances of modern warfare, bombarded a plague-stricken population for fourteen days before he obtained possession of the fortress.

I have no doubt whatever, that the verdict of history will approve the English plan of proceeding as more humane, soldierly, and in accordance with the spirit of the age.

I find that I have completely exhausted the time allotted for a lecture, and although much that I should like to have said must remain untold, I crave your indulgence for a few minutes' longer to wind up my story.

The Franco-German war has shown that, although it contains some defects of detail, and some of its provisions have been seriously abused, the Geneva Convention has, on the whole, worked well. Without organization, and barely accepted by public feeling in England, it suddenly found itself in face of the most formidable contest of any age. A few hours produced an accumulation of suffering which the medical organization of neither army was able to relieve. The National Society stepped in, and intervened efficiently to give relief on the battle field, to gather together the wounded dispersed throughout the surrounding villages, to institute temporary hospitals for their proper accommodation and treatment; to afford the medical comforts and accessory appliances which are not among the ordinary equipments of military medicine; and, above all, to afford the trained and efficient nursing which is scarcely inferior in importance to surgical skill and medical science.

All this was done with an amount of liberality on the part of the public, and of patient devotion, untiring watchfulness, absolute sacrifice of personal comfort, disregard of danger—for the enemies of peace in the shape of contagious disease, are far more formidable than the foes of war in the magnitude and destructiveness of their effects—and the exercise of Christian virtues on the part of all immediately engaged in the good work, that must for ever command our admiration and respect.

It is to be hoped that the invaluable experience acquired will be

utilized in such period of peace as may be allowed to us, in organising the means of affording relief to the sick and wounded of the wars of the future, so as to supplement the resources of the State by the aid of the civil community, and enable them to be expanded as quickly and extensively as the speed and crushing blows of modern warfare demand.

How this can best be done it is now time to consider, with the grave deliberation necessary in the treatment of so difficult a question.

I should have been glad to have dwelt longer on this point, for it is simply impossible to exaggerate its importance it may be in the near future, but I feel that it would be premature to do so until all the facts are carefully collected and collated, in order that sound principles of guidance may be educed.

The great and enlightened principle on which the Geneva Convention is based is undoubtedly correct, and, if it needed practical proof, its soundness has been demonstrated in the recent contest. To carry it to its logical conclusion is now the business of all interested in mitigating the miseries of war, until the Millenium of Peace, which appears farther off than ever, shall arrive, as it must and will in God's good time.

In conclusion, let me tell you, in the fewest possible words, the conclusions at which I arrived as to the net results of the war.

In regard to the German rulers and chiefs, their successes are without doubt primarily due to Geist—the intellect, which the old Greek philosopher many centuries since announced to be the ruler of the universe—a doctrine discussed and received by the German philosophers of the past century, and put to practical proof by their statesmen and warriors in our own time.

With respect to the instrument used—the rank and file of the great German force—their success was in large measure due to Beef, Beer, 'Baccy, and Boots, as I could show if time permitted, for each of them played an important part in the military operations of the now historical seven months' campaign.

A learned and ingenious friend of mine, who saw much of the German armies, considers that boots, booty, and beauty should be inscribed on their standards.

In relation to the French, it would be ungenerous to judge their chiefs in the hour of adversity, and in any case until they have been heard in their own defence.

But the ill success of the French Armies, apart from questions of policy and strategy, was caused by Indiscipline and the Intendence. It was impossible to listen to their simple tale of the cold, starvation, want of clothing and ammunition, and absence of the ancient military spirit of France in her Officers, with which, as a rule, the men were led to the slaughter, without feeling surprized that they should have made head at all against the best-trained, best-disciplined, and best-led soldiers of the age. That, in such circumstances, they should in some of the battles of the north of France have approached the very verge of victory, proves that the children of France have not degenerated in courage. I myself believe that when France recovers

from her present afflictions, and takes to heart the lessons taught by her present misfortunes she will rise to greater eminence than ever, and come out purified by the great fire of adversity.

"I see thee yet, fair France—thou favoured land
Of art and nature—thou art still before me.
Thy sons, to whom their labour is a sport,
So well thy grateful soil returns its tribute;
Thy sun-burnt daughters with their laughing eyes
And glossy raven locks. But favoured France,
Thou hast had many a tale of woe to tell
In ancient times as now."

Evening Meeting.

April 24, 1871.

REAR-ADMIRAL A. P. RYDER, in the Chair.

NAMES of MEMBERS who joined the Institution between the 17th and 24th April, 1871.

LIFE.

Barstow, John A., Capt. 89th Regt.

ANNUAL.

Watson, T. C., Lieut. late 75th Regt.	Little, H. A., Capt. 7th Fusiliers.
Cory, Arthur, Major Bengal Staff Corps.	Hudson, John, Lieut.-Col. Bengal Staff Corps.
Bullen, Charles, Comr. ret. R.N.	
Luke, J., Esq., Surveyor and Inspector of Contract Work, Admiralty.	

CONSIDERATIONS ON A NEW FORM OF IRONCLAD PROPOSED

By Captain JOHN WHEATLEY, R.N.

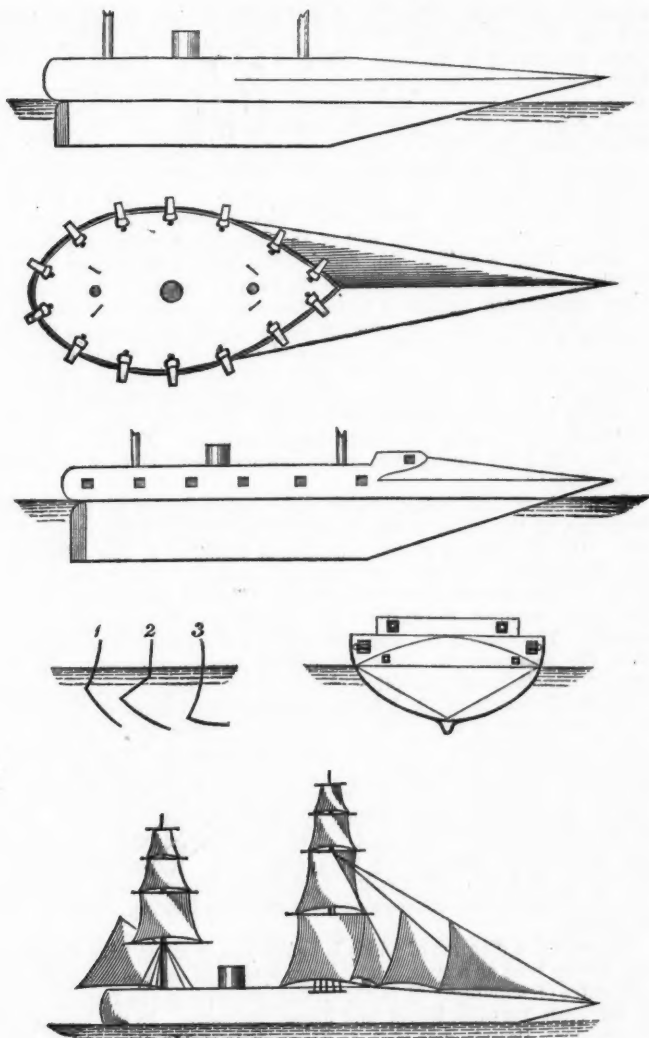
THE competition which has long been going on between guns and armour plates, is conclusively settled in favour of the gun over any plates that a sea-going ship could carry by the successful completion of the Woolwich 35-ton gun, with power to construct larger guns still in reserve. Under these circumstances, and accepting these conditions, it must be evident that the gun, that is, the power of the gun of other countries, and the size, weight, and power of our own gun, must be the chief consideration in the design of the ships; and that the best form for a sea-going ironclad must be that which exposes the smallest surface to shot striking at right angles, and possessing at the same time unquestionable stability, high speed, capability of carrying the full proportion of sail of former wooden ships, with full steam power, easy steering, and rapid turning.

Now that by the addition of 350 tons of ballast, the stability of our present ironclads is so far re-established as to admit of their being sent to sea without risk, in position of attack, that is, broadside-on, they

expose a very large surface for shot to strike at right angles, probably not less than 280 feet by 20 feet of penetrable armour, which armour when penetrated is the very reverse of a defence. Turret ships with high freeboard—rather an anomaly when with penetrable sides—expose about one-third less, but their hurricane-deck may be cut through and come down on the turrets. A writer in *Blackwood's Magazine* for March, states that the “‘Audacious,’ when broadside-on, presents an “area of 6,670 superficial feet; and of these only 3,207, or less than “half, are plated at all. There is a patch of 100 feet by 3 at the “water-line of 8-inch armour, which tapers down to 4½ inches at the “bow and stern; and the rest of the ship has nowhere any thicker “armour than 6 inches, the ends of the main-deck battery having “only 4 and 5-inch armour, while the ends of the upper deck battery “are unprotected against a raking fire, and more than half the ship’s “side is in the same unprotected state. A roll of 4° would lift the “8-inch belt well out of the water, and a roll of 10° would show the “unarmoured hull, and we hear that on the trials outside Plymouth “harbour, the ship, without a sail set, heeled over 16°, and the Admiralty have been compelled to have the rig of the ship altogether “altered, and her sails and masts largely reduced. Yet these are the “ships which are supposed to constitute our second-class of broadside “ironclads!”

It has been said several times, and it was repeated by Sir George Sartorius, at the close of the discussion on Admiral Fishbourne’s lecture “On the Causes of the Insufficient Stability of Her Majesty’s late Turret-ship ‘Captain,’ and of other Ironclads,” that it was for the sailor to describe the sort of ship that he required, and then it was for the naval architect to construct her according to the principles of his science. Therefore in the diagrams before you no more lines are given than are necessary to show the sort of vessel proposed. All our present ironclads, and, excepting circular or star-shaped forms for coast defence, all vessels which I find proposed in the Journal of this Institution, are based on the model of the Deal, or rather Dover galley as a type, the former being formed for beaching, while the latter lies afloat, a very good form for packets or passenger boats going straight on end, but whose unhandiness for general purposes, and specially for ships of war, is shown, even when manned by those most accustomed to them in the indispensable “duck hunt” at all regattas; and this unhandiness has been further increased by the plough bow. It has been stated in this place that the “Monarch” took three hours to veer! I leave you to imagine the consequence if a ram was bearing down on her broadside.

The vessel, a diagram of which is before you, is taken from the Bombay fishing boat as a type, whose large spread of canvas is a sufficient guarantee of stability. It is the ruling principle in the form of most of the craft between Egypt and Japan inclusive. In the account of Commodore Perry’s first visit to Japan, it is stated that a Japanese boat took off some American Officers to their ship quite dry in weather which quite wet through the Officers who went in their own ship’s boat. The Chinese fast boats, the Thames wherries, and that noble wherry,



1. "Rupert."

2. "Devastation."

3. "Hercules."

the beautifully-formed Lord Mayor's barge, are all examples of this principle, though the barge, of course, is adapted only for shallow water. Taking these diagrams to represent a vessel whose extreme length is 300 feet, her beam one-fourth of her length, 75 feet, enabling her to carry 14 35-ton guns, weighing, with 23-ton carriages, 790 tons, that is little more than double the extra weight of ballast put into our present iron-clads to make them seaworthy. She will have an all-round fire without any impediment; bringing, on Captain Scott's system of mounting, from 3 to 4 guns to bear, and 8 ahead and astern, and 7 broadside on Captain Moncrieff's on every point of the compass; on Moncrieff's never less than 5, without altering her position; while in proportion to the weight of metal carried, she exposes less than half the surface to shot striking at right angles than any other sea-going form, obtaining by the oval, part of the advantage of the turret, though not quite to the same extent as the circle for defence, but, on the other hand, superior to the revolving turret for attack by the guns being placed on a curve, thus having a gun always bearing on the attacking vessel.

At present no vessels are quite equal to our new breastwork monitors, but they will be enormously expensive, and we require a numerous fleet as well as a fleet of ships individually powerful. The proposed form admits of the fullest use of sail* power, without any risk of the gear interfering with the guns; and, by the adoption of the hydraulic propeller, obviates the objection brought against the use of masts and sails on account of their fouling the screw if shot away. The following account of the "Hercules," as our best present sea-going ship, is taken from *Blackwood's Magazine* for March:—

"The 'Hercules' is the only one of our first-class ironclads which has yet been tried at sea, and it is due to her constructors to say that she has proved a great success. Her armament is very powerful, and consists of 14 rifled guns, of which eight are of 10-inch, two of 9-inch, and four of 7-inch calibre. Her water-line is defended by a belt of very thick armour, perhaps impenetrable at the thickest part by any of the guns she carries, and extends for about 3 feet above and 3 feet below the water-line from stem to stern of the ship. As long, therefore, as the sea is sufficiently calm to confine her rolling to 6°, it is probably impossible for any ironclad now afloat in any foreign navy to deliver a shot which of itself can sink her. This great defensive strength is, however, confined to her belt; the battery from which her largest guns are worked is only protected with 6-inch armour, and experiment has shown that armour of that thickness, with the ordinary backing, can be penetrated at a distance of 1,000 yards, and at an inclination of impact of 30°, by the 9-inch rifled gun, and at close quarters by the 7-inch rifled gun, such as is carried by all except one of our present ironclads. But the 'Hercules' has other excellencies; she is, for an ironclad, a fair sailor, though awkward in tacking or wearing. She has a speed under steam of 14 knots, and is a very steady ship, and can, therefore, use her great offensive powers under conditions of sea in which a less steady ship

* The masts and sails are not drawn to scale, but only to show the rig.

"would be almost *hors de combat*. Of our other first-class ironclads "the 'Sultan,' which resembles the 'Hercules' in most essential "points, has been launched, but has not been tried. It is said she is "deficient in stability." So far *Blackwood*. Broadside-on, her position of attack, the "Hercules," with a length of 925 feet, exposes about 300 feet by 30 of penetrable armour. With my vessel the position of attack will be stem-on; in this position she will bring, on Scott's system, four 35-ton guns, on Moncrieff's eight 35-ton guns to fire in a line parallel to the keel behind armour quite as secure as that of the breastwork monitors, and presenting an acute spherical angle to the enemy's shot. My vessel's weakest point will be the broadside. Should she be attacked on the broadside as well as ahead, she will bring five or seven guns to bear, as repelling forces, but the defence will be weaker than stem-on, inasmuch as allowing for the great strength required for the gun-deck, she would probably not carry more than a 10-inch water-line belt of 6 feet, surmounted by 6-inch plating throughout, but the whole may be faced with 18 inches of teak (taking a leaf out of Mr. Hyde's book*) as the wood that splinters least and that suits best in contact with iron. Broadside-on, my vessel would expose about 130 feet to shot at nearly eight angles at the water-line, to about 300 feet of the "Hercules," with the same armour. On the gun-line, and above, my next ports to the beam-gun recede 10°, the next two 20°, and the next 50°; this, with 24 feet from gun to gun, makes 96 feet, in all about 120 feet; that of the "Hercules" remaining at 300 feet penetrable armour, while the repelling force of my guns will be at least double the force of the "Hercules'" guns.

I need say nothing here as to the advantage of masts and sails, over very large vessels navigated solely by steam, in point of economy, nor as to that of their being the only resource in case of damage to machinery. With vessels on a wind the greatest pressure, and of course the greatest obstruction to speed, is on the lee-bow. This pressure has been greatly reduced by the prolongation of the lines in the plough-bow, but the advantage has been more than counterbalanced by a further addition to the difficulty of steering and turning. In the diagrams before you, the entrance at the water-line very nearly coincides with Mr. Scott Russell's line of least resistance; there is an upward pressure increasing with the speed of the ship, and this upward pressure is further increased by the action of the head-sails, which all have a lifting power tending to reduce friction in passing through the water. The following is an extract from the *Globe* of March 4th, 1871:—"The Royal Commission on the construction of ships, who "visited Devonport this week to test the ironclads, have condemned "the 'Waterwitch,' worked by hydraulic apparatus, and the only ship "of her class. The performances of the 'Hotspur' as to speed, power, "and safety were satisfactory; but owing to her weight and form of "bow, which is built to allow firing straight ahead, she lies dead in "the water, and when driving at full speed against a head sea, three "tons of water were taken in at port of the turret, which was experi-

* This, however, is a naval architect's question.

"mentally opened for five minutes only. The Committee approve of her for coast defence, but will decline to pronounce her suitable for ocean voyages."

As Admiral Elliot, who was a strong advocate for the hydraulic propeller, was one of the Committee, there must have been good reason for the condemnation of the "Waterwitch;" but the principle has more than once so nearly reached success that we may still look forward to it as our best motive principle. The immense quantity of water shipped by the "Hotspur" is probably owing to the concave shape of the plough-bow just below the surface of the water, the pressure being downward and therefore destructive to speed, and carrying the water upwards.

In a question of national existence,—for, deriving so much of our subsistence from abroad, were our fleet defeated, we might be starved into submission on the most humiliating terms without an enemy landing on our shores,—it would be a very great mistake not to avail ourselves of the advantage to be gained by the use of the most powerful projectiles; the difference between an 18 or 25-ton gun and a 35-ton gun might render a doubtful contest certain, with fewer damages to repair and with less or very likely no time lost by absence of the ship from her station.

With this view I propose three classes of vessels, all having the same scantling, this class before you being the first-rates; the second-rates, of 260 feet length with 65 feet beam, to carry eight 35-ton guns, weighing, with carriages, 440 tons; third-rates, 220 feet in length with 55 beam, carrying four 35-ton guns, weighing, with carriages, 220 tons; the first and second-rates bring four or eight,—according to the system adopted,—guns to bear right ahead behind impenetrable armour, and the third will bring two or three under the same conditions. I do not allude in any way to gunboats carrying one gun. It must be borne in mind that the smaller the vessel in a sea-way, the greater the disturbance to correct aim, and that in case of a miss, it is of great advantage to have another gun ready, as these guns cannot be reloaded very rapidly; and though the large ship may cost more, she will also be worth a great deal more. In the next naval war we shall have to seek special precautions against that most destructive weapon, Harvey's sea torpedo. In the trial between the "Royal Sovereign" turret ship and the "Camel" with these torpedoes, the "Royal Sovereign" at anchor was supposed to defend herself against ten different attacks, the turret ship being armed with five guns. The torpedo was successful eight times out of the ten, each touch representing total destruction, the "Royal Sovereign" firing during the first attack seven times; second attack four times; third, fourth, fifth, sixth, and seventh attack twice; eighth and ninth attack only once. On the following day, with the "Royal Sovereign" under weigh, the torpedo vessel made six attacks, failing only once, the "Royal Sovereign" firing ten, twelve, seven, two, five, eight rounds during the successive attacks; and it was remarked at the time that had these guns been shotted very few of the shot would have struck the "Camel," this in smooth water, at an extreme distance of sixty

fathoms, thus showing the necessity of having guns laid for an attack in any direction.

In the article in *Blackwood*, from which I have received so much information, it is stated, that "Every break in the armour-plated side of a ship is a necessary element of weakness, especially in the present day, when breechloading rifles from the enemies' marines may be expected to pour a volley through every open port-hole." Every ship of war of whatever form must be a compromise between difficulties. The intention of the rifled gun is to enable you to destroy your enemy at distances of from one to two thousand yards; thus I cannot imagine where any body of riflemen could find a near-enough platform whence to discharge a volley into any ports in case of the adoption of the Scott system instead of the Moncreiff.

Extracts from Mr. E. J. Reed's "Our Ironclad Ships."

Chapter vii, p. 140. "Rolling."

In fact, the heavier a ship is, the greater is the resistance she offers to being set rolling, a statement which it is scarcely necessary to illustrate, as we are all familiar with the fact. It is true that great weight tends to sustain motion when it has begun, but even then it does not increase rolling. In fact, as far as the mathematical theory of rolling goes, a ship's behaviour is entirely independent of her weight, although the heavier ship requires a greater effort to set her rolling than a lighter vessel.

Chapter vii, p. 178. "Dimensions, Turning."

	Length.	Breadth.	Prop.	No. of men steering.	Circle.	
					Yds.	Time.
Bellerophon, balanced rudder.....	300	56' 1"	5' 3"	8	401	4' 47"
Minotaur	400	59' 4"	6' 7"	78	939	7' 38"
Lord Clyde.....	280	58' 11"	4' 7"	12	379	4' 54"
Achilles	350	58' 4"	6' 5"	—	618	6' 40"
Warrior					760	7' 46"
Hercules, jointed balanced rudder.....	325	59	5' 5"	16	562	4'

P. 181.

Our experience with long and short ironclads may be fairly stated as follows—that the short ships may be driven as fast as long ships by a moderate addition to their engine power; that in turning power and general handiness under steam and sail, the short ships are much superior, and that the great reduction in prime cost of short ships much more than makes amends for the addition to the steam power.

Chapter ix, p. 196. "Forms and Proportions."

In armoured ships, as the extent and thickness of the armour are increased, the proportion of length to breadth should be diminished and the fulness of the water

lines increased; the shorter fuller ship can be propelled at as great speed as the longer finer ship, with about the same or only a little greater horse power.

In longer ironclads the proportion of frictional resistance becomes considerably increased.

Extracts from Mr. J. M. Hyde's Lecture on Deflecting Armour Plated Ships for Coast Defence.

Journal of the Royal United Service Institution, No. liii, pp. 133, 134, 139.

Mr. Hyde's experiments were made with a gun representing a 25-ton 12-inch 600 pounder, at a range of about 17 feet, representing 70 yards, and the results bore the same proportion to those of the service gun.

With a target representing the angular side of his ship (20° from horizon) one half faced with wood and the other bare, the wood made the shot ricochet; the metal showed a small indentation only.

Since writing the above we have had letters from Sir Spencer Robinson in the newspapers, stating that other powers are building on the models of "Hercules" and "Devastation." It is clear that Russia is putting efficiency before economy, and that part of her new loan will go to pay for the heavy breechloading guns of which we read in the *Standard* of the 8th instant. Prussia in her last two wars has acquired ample means of proceeding on the same scale. There can be no question as to the object of these armaments, and unless we are prepared to meet them our prospects are not very gratifying. I therefore propose to increase the scale of my ship to 340 feet length, 85 feet beam, and to guns of 60 tons, throwing 1,200 or 1,500 lb. shot; and that no time should be lost in testing Captain Moncrieff's system, which either increases one-third or double the force of the ship. In one of our present sea-going ships,—perhaps as she is without ports the "Monarch" would be the best,—three guns of the same calibre should be substituted for the turrets, there would still be space for two more, and thus her attacking force would be doubled. As it is one of the inevitable consequences of the progress in ships and guns that the ship of to-day becomes obsolete to-morrow, it is perhaps wisest, and in the end cheapest, to go to work at once on the largest scale possible. Captain Colomb's most important and suggestive lecture on "The Attack and Defence of Fleets," shows the advantage of the ram over the gun as a weapon of attack, and also that the proportionate power of the gun has receded as its size has increased. Since the war of the first Napoleon, we have had two actions of fleet-to-fleet—Navarino and Lissa; but we have had Algiers, Acre, and Sebastopol; Cronstadt was considered unassailable with the means we had then at our disposal. In the American civil war, ships were successful over forts at New Orleans, Mobile, Fort Fisher, and failed only at Charleston. In all these cases the gun was the only possible weapon.

In addition to the other advantages of the form I propose, I submit that the proposed vessel possesses very superior advantages as a ram, the weight of head and stem assisting. It has been found with projectiles that the sharper the point, the deeper the penetration; should this be so with a ship, as is most probable, this vessel would simply split any other in two and pass through her, while as a defence, pre-

sending her stem, the approaching ram would either spit herself on the point or pass along side without doing harm.

Torpedoes.

As all ships can use torpedoes, I look forward to the time when ships will no more be sent to sea without a store of Harvey and other torpedoes, than without boats or anchors.

According to Captain Dawson's lecture, the force of torpedoes does not extend in water beyond 20 yards, so that ships of the proposed form may easily sweep a channel clear of stationary torpedoes by proceeding in pairs with the stream or kedge chain extending across the channel from outriggers on the off bow of each ship, stiffening the chain with spars if the bottom is steep; an operation which could not be carried out by ships of the present form.

With the supremacy at sea, blockades may be secured by a torpedo cordon moored across a harbour's mouth, excluding access or egress of any kind.

In the First Lord's speech on the naval estimates he stated, that "It seemed to him to be an impossible problem to combine a first-rate fighting ship with a first-rate sea-going ship." It has been my endeavour to combine a first-rate seaboard with a first-rate steamer, and first-rate sailing ship with a first-rate fighting ship, armed at all points, whether for gun, ram, or torpedo warfare.*

The CHAIRMAN: Does any gentleman wish to ask any question or to make any observations upon the paper just read? I should like to lead off by asking two questions. What is the freeboard of your largest vessel? Also what is the height of the hawse-holes above the water?

Captain DAWSON, R.N.: The only questions I should like to ask are whether these are a series of guesses, or whether there have been any calculations made to justify the supposition that a vessel of those dimensions would carry the weights that are there stated? And how are we to guard against the guns on the Moncrieff system firing into one another? I would also say that you misquoted me. I never said that torpedoes could strike a vessel 20 yards from the place of explosion; it was 10 or 15 feet.

Captain WHEATLEY: That is the better for my vessel.

Admiral of the Fleet Sir GEORGE SARTORIUS: I wish to ask you, in attacking as a ram, what would be your mode of attack? I do not mean end-on, because no ram of that kind would attack end-on. But in attacking, how do you calculate upon attacking as a ram a ship on her broadside? Also what is the power of penetration?

Mr. HYDE, C.E.: I should like to make a few remarks. It appears from the design that Captain Wheatley has produced, that all his guns would be placed in one huge battery. Now, unless the sides of his ship would be invulnerable, the effect of shells

* Captain Wheatley has requested that the following propositions may be added to his paper.—ED.:—

1st. Neither light draught of water nor reliable stability under sail are attainable with narrow beam.

2nd. High speed is only attainable by considerable length in proportion to beam.

3rd. Abundant proof exists that there is no absolute necessity for this length to be in the form of an elongated vertical parallelogram.

4th. Abundant proof exists that according to the elongation of the above-named form the efficiency of ironclad ships of war is diminished.

getting into that battery would, I think, be rather serious for the crew who were fighting the guns. It has been argued that the great point in all future warfare should be to keep the shells out of a ship, because they seem to do more mischief than any other projectile. So that unless the sides of the ships were practically invulnerable, shells would necessarily get through; and you can well imagine the effect they would produce among a crew so confined even in so huge a battery. The forward end of the ship, of course from its construction and from the angular sides it presents, would be practically invulnerable. Now, if it be necessary to make the end of the ship angular, and hence invulnerable, why not carry out the angular side all round the ship and place your battery in the turret gun-carriage? Turrets are really invulnerable gun-carriages; and if the turrets were armed with these modern 35-ton guns, the power of which is hardly yet known, the turrets being practically invulnerable, the shells then would not get in among the crew. The remark I wish to make is simply this, that if it has been shown that the sides of our ships are penetrable to our modern shells, then these vertical sides would still be practically useless for the protection of the gunners and those who serve the guns. Also if it be necessary to make the bows of the ship angular to keep shot and projectiles out, why not carry the angular sides all round the ship?

The CHAIRMAN: Perhaps, Captain Wheatley, you will now reply. You did not mention the speed or the coal carried.

Captain WHEATLEY: Your first question was with regard to the height of the freeboard. The lower sills of the port are 7 feet 6 inches above the water-line, and of the hawse-holes 7 feet. That is about the height of those of our frigates in the last war. Of course they may be made a little higher if it is necessary. With the 35-ton guns, on Captain Scott's system, it is necessary to have the 'tween decks rather higher than on Captain Moncrieff's system, the greatest diameter of the gun being 4 feet 8 inches, to allow for the gun-carriage and for the necessity of elevating and depressing the gun. Captain Dawson wants to know on what data the vessel is designed. I can only say that it is designed from the models which we have before us, just as others are designed, from the Deal galley, or rather the Dover galley. It is the same design increased to the size and necessity of a man-of-war. I am very much obliged to him for putting me right about the torpedo. I gave the torpedo credit for more power. It is more easily got rid of by a ship of that form, that is to say, the engineer's torpedo fixed upon the ground. Sir George Sartorius wished to know about the attack. The attack would be made by the ram stem-on. I know of no other way in which that ram could be used. The point of the ram is 7 feet 6 inches above the water-line. The projection of the stem of the "Rupert" is I suppose about 4 feet below water-line, that of the "Devastation" still lower, and that of the "Hercules" about 10 feet below the water-line. If you brought the plough-bows of these vessels against my ship they would not touch any part of her; and again, if they missed the point they would slide along the side and could not do any harm.

Sir GEORGE SARTORIUS: But when you are attacking an enemy's ship as a ram, the point of your vessel would be considerably above the water-line.

Captain WHEATLEY: It would strike the ship a little above her belt.

Sir GEORGE SARTORIUS: The great object to be gained by a ram is to strike underneath and sink the ship, which yours would not do.

Captain WHEATLEY: By the ram striking above the belt and making a wide hole, not a thin hole like the cut of a knife, the weights of the ship's head and stern would immediately come into play to break her back. The fore and aft parts would part even from the force of the blow; there would be nothing to sustain the head and stern of the ship attacked. The head and stern is much heavier than the midship section; and if the midship section is cut through, she would break in two.

Sir G. SARTORIUS: If the two vessels were going fast through the water the nose of your vessel would be run off.

Captain WHEATLEY: It might be; but recollect it is not a thin plate, it is supported on each side; and if it was, breaking it off would do no great harm. But that remains to be seen. I should be very glad to see an experiment on a small scale with

a vessel of this form. Speaking about the effect of shells, does the gentleman who asked the question mean vertical or horizontal fire of shell, because that would make a difference. The ship is impenetrable to the horizontal fire of shells; you cannot protect the ship against vertical fire.

Mr. HYDE: But you can drive a shell through a 10-inch vertical plate.

Captain WHEATLEY: This is the angular form of the ship's bow; and she brings eight guns to bear on the Moncrieff system.

Mr. HYDE: But I mean on the broadside.

Captain WHEATLEY: On the Moncrieff system all these guns turn on the broadside, and there is a greater force of guns than in any vessel of any other form. The "Hercules" can only bring four guns to bear.

Captain GILMORE, R.N.: If it is merely a question of the damage done by shells after entering a battery, it is easily obviated by having a traverse between the guns.

The CHAIRMAN: With regard to the report you quoted from a west country paper about the visit of the Committee of which I am a member, the words used could not be justified at all. The words used by the person who wrote in the paper expressed no opinion at all; therefore you may set that on one side. (Captain WHEATLEY: Very well.) I am sure that I only express the sentiments of all present by returning our thanks to Captain Wheatley. All papers on these subjects are very interesting, and anybody who will contribute to our knowledge will always be welcome.

Captain Wheatley is desirous that the following notes should be added, as he did not at the time clearly understand the question put:—"With regard to Captain Dawson's question, as to previous calculations, it is answered, by the opening statement that mine is only the "sailor's vessel," its construction is for the Naval Architect. I know of no formula for calculating the tonnage or speed of such a vessel, or whether those cited for the present forms would apply; but taking the tonnage to be nearly that of the Minotaur's, it must be ample for the weights proposed.

"With respect to the further discussion on the ram, such questions can only be decided by experiment. Several vessels are sunk every year by collision, without being struck by a plough-bow. In my opinion, in the case referred to by Admiral of the Fleet, Sir George Sartorius, as to the rammed vessel going at speed, the knife-like projection of the plough-bow is more likely to be wrung off, and with greater danger to the ram, than with my vessel, a double wedge strongly supported; a wedge is also the form that most easily withdraws from the hole it has made."

ARE THE ROYAL MARINE FORCES A NECESSARY AUXILIARY TO THE ROYAL NAVY?

By Major-General SCHOMBERG, C.B., R.M.A.

In the revolution that has taken place during the last few years in warlike matters, naval and military, a question is often asked, Is there now any necessity for the maintenance of the Royal Marine Forces as an auxiliary to the Royal Navy?

The question is an important one, for the marines have been hitherto not only an auxiliary to the Navy, but its first reserve, a reserve which could be always depended on; which never failed. As an Officer of Marine Artillery, I crave permission to examine this question, and will endeavour to do so as dispassionately as possible.

Those who think that there is now no necessity for marines, hold that opinion on the following grounds, viz., that the presence of Marines on board ship is only necessary for the sake of discipline; or in the event of that force being required as a landing force.

I am not disposed to allow the argument to be narrowed to these points; I hold that the Marines are still the first reserve of the Navy, the readiest, the best disciplined, and the cheapest reserve that can be obtained.

In peace there may be little necessity for such a force; I say "may be," for this is doubtful, and has never been put to proof, though the proof would not be difficult: but the Navy is now in admirable order, and the men carefully selected and trained; a marine detachment *may* therefore not be an absolute necessity on board ship during peace.

But let us imagine a great naval war,—which the Navy is paid and maintained to meet,—to break out; let us imagine a combination of any two of the great naval powers with the minor ones against England. Every ship in English water must be put to sea or manned; there would be losses, and a much greater demand for sailors than there was in the Russian war, which was not a naval war. No one in this generation has seen anything of the kind, and past experience is always forgotten. The Americans, if not our enemies, would be not benevolent neutrals; they would absorb the carrying trade of the world during the war, and bid high for sailors; the seas would swarm with privateers; the fierce passions aroused by such a war would but too probably tear bygone treaties to shreds.

The Navy of England is nothing if it cannot meet such a crisis; but the pure blue jacket Navy, even with the addition of the Naval Reserve—when they could be got at—could not half man the ships that would be required.

A question was lately asked within these walls, whether in a future war sailors would be required in the large numbers found necessary during the last great naval war, as modern ships and guns are aided by machinery, and can be worked by fewer men. I affirm that more men than ever would be required, as we have more to defend. The colonies, Liverpool, the Bristol Channel, the Thames, the Tyne, the Forth, the Clyde, Belfast; all these, and more than these, must be securely held, not only by torpedoes, but by monitors and gunboats, to leave our sea-going fleets free; and the crews of these vessels should be trained and instructed men, acquainted with the complicated mechanism of modern artillery, and many of them of large stature and great strength, to deal with 18 and 35-ton guns.

The present Navy, comparatively small, could not be made expansive enough, under any system of reserves, to meet such a pressure as this; it must be increased by a large addition of men of all characters.

I repeat, the Russian war and its experiences can give little idea of what would occur on the occasion of a great struggle for the sea.

Can a reserve of 14,000 loyal, trained men, accustomed to ships and naval discipline, be dispensed with, if such a crisis as this described be possible? It may be answered, a standing Navy, with the men quartered in barracks, would meet these requirements. Such a

standing Navy exists only in theory, and the question arises, would not sailors passing a large portion of their service in barracks on shore, lose their seamanlike qualities and knowledge? Would they not cease to be sailors? They would be very expensive Marines, if they answered their purpose, which I doubt; for it must be remembered that mere drill does not make a soldier, nor do mere good behaviour and sobriety, make discipline.

Now the conduct and behaviour of Marines afloat have of late been severely attacked by many Naval Officers. It must be remembered that the discipline of these men is submitted on embarkation to a crucial test; they are taken from the command and authority of their own Officers, and thrown under that of other Officers. With that fatal bias towards centralization which has caused so much mischief to both services, Army and Navy, all power of punishment is now taken from the Marine Officer* embarked in nominal command of these men. This used not so to be; and I affirm that it is the chief cause of the misconduct and absence of which we have lately heard so much.

The men of the Royal Navy have been carefully weeded of bad characters since the Russian war; they behave well; but subject them to the same test as that undergone by the Marine, would they behave better?

I repeat, good behaviour and sobriety do not alone mean discipline. I could bring recent instances to prove that the old, strict unquestioning discipline of the Royal Marine service,—that readiness to go anywhere,—obey any order,—does not slumber.

In the able paper on "Naval Organization," read by Captain Colomb, in this Institution, he praised the Marine system and organization. He rightly stated that it differs from the Army system, "and has been the silent quiet work of generations of unknown Officers." "Sic vos non vobis" might well be their motto; and this silent growth of a century, his proposal would destroy in about three years; for the destruction of the organization he praises, would be the sure consequence of the transfer of Officers suggested by him. He contemplates the destruction of the Marine Force, for his expressions are:—"The Marine Infantry would gradually cease to exist. The Marine Artillery would in like manner be absorbed in the Navy proper." The Navy proper would, I imagine, be composed of men who could do all duties afloat and on shore; soldiers who could not only perform deck-duties, when embarked, but go aloft, and be thorough seamen. Either this—which I believe to be an impossible thing—or a Marine under a different name, and a far inferior article.

But the chief objection to trusting to a reserve of pure blue jackets only for the Navy is this, that it is an unsafe reserve, inasmuch as all nations bid for the service of English sailors, and the bidding would rise high in war. And here I will quote a short passage from the

* I am glad to correct the above statement—the power of inflicting minor punishments has lately been restored to Marine Officers.

speech of the First Lord of the Admiralty, in moving the estimates for this year. He says,—“I will frankly state to the Committee that since September last, it has been wished to secure an additional 450 blue-jackets for the Navy, but that we have only succeeded in obtaining 50 out of that number from the shore.” This speech is made in March, and needs no comment from me in its application to the present subject.

In conclusion, I submit that the changes in warfare of late years do not render the Marines a less efficient reserve and auxiliary to the Navy than heretofore. No such logical conclusion can be deduced from the fact, that from the use of steam machinery, ships may be efficient when half manned by Marines, or by any trained and disciplined men, who have sea legs.

These changes have really increased the value of the Marine Infantry and Artillery, as the reserve and gunnery reserve of the Navy, which, if fostered, not discouraged, would surely enable England to double her Navy for the first blow in a great war. But if this force be a State necessity, Officers and men must be encouraged to perform their duties zealously, and important duties and useful employment afloat, even in peace, must in consequence be assigned to Marine Officers and men.

If I may be allowed to quote personal experience, I can state that in bygone years, as a subaltern and captain, in peace and war, I performed, when embarked, as important duties as an Officer of those ranks can be called on to perform.

There is a hesitation among Naval Officers in either forming or expressing an opinion on the necessity of the Marine branch of their service, which was very apparent within these walls at a late discussion, and which I watched with attention. This has induced me to submit this paper for your consideration; a short, and, I fear, inadequate statement of the subject.

But it is not a time to halt between two opinions; such halting and hesitation I believe to be causing mischief to one service, and ruining the auxiliary one. Nor is it a time for disguising facts, and it is a fact, that the idleness, I may almost say enforced on Marine Officers afloat, their removal from all control of their men, and such circumstances as those attending the Abyssinian campaign, must choke the zeal and *esprit de corps* of Officers and men.

The decision rests with the Officers of the Navy. If our day be over, and our usefulness a thing of the past, we accept our dissolution as loyally as we have any other duty. “*Morituri te salutant.*” We have done our duty, and hope our successors, whoever they may be, may perform their part. But if, as I believe, we are more than ever necessary, and that steam and machinery have increased our value, then we claim from the Navy support and encouragement of a zeal that has never flagged, of a loyalty that has never wavered.

Note 1.

I submit a few suggestions as to the employment of Marine Officers and men when embarked.

There must always be a difficulty in peace with regard to the instruction and training of a reserve. This difficulty should not be so great with the Marines, which is an auxiliary as well as reserve.

Embark captains sparingly during peace, as modern ironclads do not require the large detachments of Marines carried by the old line-of-battle ships. One captain of Marine Artillery, and two of Light Infantry, would probably be sufficient for each large fleet, Channel, Mediterranean, North America, Pacific, China.

The junior subalterns should assist the gunnery officer of the ship in carrying out the drills and instruction: gunnery, rifle, cutlass. In ships on the home station, seamen gunners and Marine Artillery should not be embarked together.

In some few ships, the gunnery instruction should be exclusively given by the Officers and men of the Marine Artillery. The Marine Artillery should also assist in the gunnery instruction of the naval reserve.

In turret ships, relief guns' crews will be very necessary for the guns in the turrets; one relief should be composed of Marine Artillery and Infantry.

All minor offences of Marines afloat, should be dealt with by their Officer. No other Officer, except the commanding Officer of the ship and the Marine Officer, should have the power of punishing a Marine.

Battalions of Marine Light Infantry and detachments of Marine Artillery should be posted at Halifax, Gibraltar, Malta, and Japan.

Note 2.

It may not be out of place to add a short account of the training and instruction of the Marine Artillery, as illustrating the care with which Officers, non-commissioned Officers, and men are prepared for their various duties.

1. The men are first thoroughly disciplined as infantry. This, with musketry instruction, occupies about 94 working days.

2. Naval gun drill, comprising—

Heavy rifle guns.

Truck guns.

Revolving guns.—Sea service mortars.

Fitting gun gear in hemp and wire rope.

Practice.

Parts of gun, carriages, and slides; use of sights and scales; charges, bursters, projectiles, fuzes, (naval).

Occupies about 65 working days.

3. Land service instruction, comprising—

Field battery drill and practice.

Rifle and smooth bore guns on standing carriages.

" " on traversing platforms.

Siege guns.

Mortars.

Practice.

Principles of rifling, fitting fuzes, &c.

Occupies about 65 working days.

4. Laboratory; making up and filling rifle and smooth-bore cartridges; driving fuzes; fitting shell and fuzes; riveting sabots.

For non-commissioned Officers in addition—

Examination of powder—extracting saltpetre from damaged powder.

Making port-fires, signal-lights, rockets, &c.

Heavy artillery exercises,—viz., elementary instruction, &c., transporting dismounted ordnance without machines, sheers, derricks, lever sheers, gyps, laying gun and mortar platforms, sledges, sling waggons and carts, &c.

Occupies about 50 days.

The whole course for the men, with final revision of naval gun drills, occupies about 280 days; Officers and non-commissioned Officers somewhat longer. Every squad in these various drills is passed by a field Officer, and the non-commissioned Officers and men are classed 1, 2, 3, according to proficiency; a final comparison of their numbers is made when they have completed all drills. This is entered on their "parchment," and a register kept at head-quarters. Non-commissioned Officers qualify as instructors.

Great attention is paid to artillery practice with all kinds of ordnance. The recruit is first taught to point and fire from a 6-pounder gun, with a charge of 1 lb. powder, mounted on a moveable platform, to represent the motion of a ship.

The instruction of old soldiers (on return from embarkation) occupies about half the time of that of recruits.

Every man attends school in the afternoons of alternate days, until he can read and write fairly, and work the four simple rules of arithmetic.

Candidates for non-commissioned Officers must write a good hand, and work vulgar and decimal fractions. A monthly examination in these subjects is held by the 2nd commandant and captains of companies.

The men are taught to swim under the instruction of the Field Adjutant.

Officers, after passing the preliminary examination for the corps, are sent on board the "Excellent" for instruction in naval gunnery and torpedoes. On joining head-quarters, they go through the same course as the non-commissioned Officers and men, with some additional lectures from the Captain Instructor on the higher branches of artillery, manufacture of gunpowder, guns and stores, &c.

At the end of this course their knowledge of drill and powers of instruction are tested by the 2nd commandant. They are classed 1, 2, or 3, as are the non-commissioned Officers and men, and the register kept at head-quarters.

All well-behaved men who have passed their drills are employed in their various trades. All repairs of the barracks, batteries, guns, and carriages, &c., are carried out by them, at a great saving of expense to the State. A theatre was built by them, a temporary church erected,

and schools are now building. They also make their own clothing and boots.

This system is, I believe, in operation at all the Light Infantry divisions.

General SCHOMBERG: I may add that the whole cost of ammunition expended in the instruction of the Marine Artillery does not exceed £5 per man. This sum covers expenditure of gunpowder, shot, shell, fuzes, and small stores. If you will allow me, one word more. I have said nothing in this paper as to the Marine forces being an auxiliary to the Army, for I feel that we must stand or fall according to our value as part and parcel of the Navy. But I can point to very distinguished services in Canada, in Spain, China, and India, which I need not recapitulate, and to which I am sure some General Officers if they were present would bear testimony. Nor have I alluded to the position which the Marines occupy in the navies of other nations. Now, from America we have received some most severe lessons, and have profited by them. The Americans still have Marines serving in their Fleet. I do not know that they are exactly the same as ours; but they occupy about the same position practically in comparison with the rest of the ship's company that ours do, and are in the same position as regards number. The Americans have no idea of altering the force.

Captain GOODENOUGH, R.N.: I think, Admiral Ryder, that we are under very great obligations to General Schomberg for bringing forward this question, which was so little discussed the other night after Captain Colomb read his paper.* I am sure we all feel that nobody has more claim to our attention on such a subject, for nobody has more thoroughly enjoyed the sympathy of both the Marine Artillery and the Navy, or enjoyed it to a greater extent than General Schomberg. Therefore we pay the greatest attention to everything he says. In speaking to the question, which is, "Are the Marines necessary to the naval service," henceforward, I think we should recall a few general principles. We should first ask ourselves whether the Marines are not only necessary, but whether the men who are intended for the naval service will be better drilled and better exercised for future naval warfare on board ship, than a body of men partly drilled and exercised to various manœuvres on board ship, and partly drilled and exercised to manœuvres, varying somewhat from them, on shore; and whether we can afford to have three such very distinct bodies as seamen, Marines, and Marine Artillery, without weakening very much the whole of the forces, at all events one of them? We should also bear in mind that the question as to whether or not we should discontinue embarking Marines in time of peace is not an aggressive movement on the part of those who urge it, but rather one of a conservative type. We should remember that in 1844, or say about twenty or twenty-five years ago, the proportion which the Marines bore to the working ship's company, those who worked on deck and in the batteries, was considerably less than the proportion which they bear now-a-days. In a line-of-battle ship of eighty guns, with 750 men, there were just 150 Marines, and there were about 500 seamen. In the present day with a ship's company of 700 men there are 125 Marines, and there are about 250 seamen. We see at once that the proportions between the Marines and seamen working the batteries and working on deck has been very considerably altered. Is it to our advantage that that disproportion should remain, or increase? It will increase probably under present regulations, for when we look forward to the "Devastation," it is very apparent that the ship's company of the "Devastation" filled up with the same proportions as existed in 1844, will have a still larger number of Marines in proportion to her men working on deck and in the batteries than even in a first-class ship of the present day. There is also another fact, viz., that at the present time we have not got enough ships to exercise and fully drill even the number of seamen that we possess. Speaking only from rough information, not from any information which I have been

* "On General Principles of Naval Organization." By Captain J. C. Colomb, late R.M.A.

able to obtain officially, we have at the present moment ships' companies for about eight ships in the home ports. We have about three ships, I believe, ready for them to be put into. It does, then, seem to me that we should gain very much in the exercise and discipline of these seamen, if instead of having ship's companies idle in the home ports, we were employing them in some way. And it also seems to me that the evil of having a large number of seamen unemployed in the ports will go on increasing, because we know that the ships which are coming forward, of which I suppose no greater number will be commissioned than at present, will have a still smaller complement than the ships of the present day. Therefore, we may look forward to having a larger number of men unemployed in the home ports than at present. Taking all these things into consideration, it *does* seem to me that we should obtain a better force in time of war if in time of peace we were to disembark our Marine forces—if we were, as Captain Colomb suggested the other night, and in which I entirely agree—to send them to some particular garrisons which should be devoted entirely to receiving them, and if we were to compose our ships' companies in time of peace exclusively of seamen. We should then be continually exercising and drilling those seamen, and we should have the means of expanding the ships' companies in time of war by putting into the ships, not a number of men picked up along shore, as we have heretofore, but drilled and thoroughly disciplined men. I will not take any account of another Reserve which it seems to me there will be no difficulty in forming, and which may be taken into account in the future, because at present we are speaking of the Marines. But I will just notice that I cannot see any difficulty in forming a Reserve out of men who have served about seven years in the service. Instead of allowing men, for instance, to serve for ten years from the age of eighteen, and then allowing them to have another period of ten years if they wish to, I cannot see why they should not enter for seven years in place of ten, and why we should not rather urge their discharge at that time—in fact, compel their discharge, unless they are first-class petty Officers, and then compel them by the agreement which they would have signed on reaching the age of eighteen, to remain as Reserve up to the age of forty years. By that means you would have with the greatest ease, without any difficulty whatever, a very considerable and real Reserve force, beyond all comparison superior to the Reserve force which at present exists somewhere. I cannot think that it exists in reality, but it exists in a great many people's minds, and in a great many people's hopes—I allude to the Naval Reserve. In the paper which General Schomberg read, he said that to meet pressure in time of war we must increase our Navy by a large addition of men of all characters. I think it will be perfectly apparent to everybody that it must be so, unless we have such a Reserve as I have briefly alluded to. There is another point connected with the drill and discipline of Marines. It has been said—General Schomberg has not said it—but it has been said by many persons, that the duties of sentry and duties of that description could not be so well performed by seamen as by Marines. Now, to get any experience—anything at all reliable on a point of that sort, we must look round and see if there is a body of men at all analogous to our seamen anywhere, and I think we find them in the Volunteers of the American war. I remember it was a subject of general remark by those Officers who saw the operations of the Northern Armies that the sentries were beyond comparison the most intelligent body of sentries that they had ever seen. And as intelligence may be looked upon as the *forte* of our present and future seamen, I do not see any reason why the duties of sentries and duties analogous to those of sentries should not be as well performed as they now are by Marines. And, more than that, I think the performance of duties of that sort, and the minute attention to orders of which the why and the wherefore are not exactly understood, would be an excellent education for our seamen, who rather need that description of duty to make it apparent to them—for they are very good reasoners and very reasonable men—that orders must always be followed, whether they can be understood and accounted for, or not. There can be no doubt whatever that the enforced idleness of Marine Officers afloat is most prejudicial to both services, and we need only ask ourselves can we, in the ships of the future any more than in the ships of the present day, afford to have Officers afloat who have no defined

duties? It is a very remarkable point, one of the most curious things in the whole of our naval discipline, that the Queen's Regulations and the Admiralty Instructions contain no instructions on that head at all. I was going to say on the point of discipline, without going into details, or going into anything very closely on that point which should not be discussed here, that nothing can be more prejudicial to the discipline of any body of men, I do not care who they are, than that they should be at one time under one rule and at another time under another rule. I speak without reference to Officers, or their particular mode of handling their men, but we know the Army Discipline Act and the way it is commonly administered, is very different from the Naval Discipline Act and the way that is administered. I think it is a great injustice to any body of men to take them from under one Act under which they have been brought up and to which they have been accustomed, and to place them under another Act. General Schomberg has very truly said, and I think everybody will agree with him, that the Marines have never been called upon in vain; that readiness to go anywhere and to obey any order does not slumber in the Royal Marines; and that they have always been ready and always will be ready to obey orders and endeavour to fulfil duties which they are called upon to perform.

Captain COLOMB, R.N.: I find myself in some difficulty because I ought by rights to stand here as an opponent of General Schomberg. But reading his paper closely over and listening to it, shows me that there are very few points indeed in which I, and what the *Army and Navy Gazette* calls the "young Navy," do not fully agree in. Before I make my own remarks, I may say I have been commissioned by my brother, Captain Colomb, to express his regret that he was unable to come over and answer General Schomberg himself, and to read a very short paper of his which, with the Chairman's permission, I will do.

The CHAIRMAN: It is an unusual course, but under the circumstances I do not suppose it will be objected to. A paper was read by Captain Colomb, "On General Principles of Naval Organization," and the paper read just now takes another view. Captain Colomb is unable to be here, and he asks that his brother may be allowed to read a short note of his on the subject.

The following communication from Captain Colomb was then read:—

The question to be discussed is, are the Royal Marine forces a necessary auxiliary to the Royal Navy? Now the presence or existence of an auxiliary force can only be necessary when there is either no real reserve available, or when the reserve is inadequate to meet probable requirements. To argue that a naval auxiliary force must ever be maintained, is to assume that it is impossible or inexpedient to have a sufficient and efficient naval force in reserve!

Granting for the sake of argument that that assumption is justifiable, the question before the meeting resolves itself into this form. Is the constitution and application of the Royal Marine forces adapted to the conditions to be fulfilled by the auxiliary force of the Navy proper? And this question I meet by a direct and decided negative, for the following reasons:—

1st. Because the present application of the forces, leads to the exclusion of a very large number of Officers and men of the Navy proper from participating in the active duties of their profession. During peace, every Marine Officer and every Marine employed as part complement of a ship is occupying a place which might be filled by a naval Officer or seaman. The interests of the Navy proper are thus sacrificed to those of the Navy auxiliary, which is false in principle.

2nd. Because the present constitution of the Royal Marine forces is an anomaly, the non-commissioned Officers and men being naval auxiliaries, while the Officers are not. The Officers are only useful to the Navy indirectly, that is, in training their men to perform duties afloat, while they neither do nor can perform any naval duty themselves. When the non-commissioned Officers and men are required afloat, the occupation of the Officers is like Othello's—gone. I cannot see the advantage or object gained to the Navy by the maintenance, in its auxiliary branch, of a body of highly trained and educated military Officers, whose duty ends the moment that of their men really begins, more especially when naval Officers could train the naval auxiliary force equally well. I am not aware of any duty performed by Marine

Officers afloat which is not daily being performed by naval Officers as part of their ordinary routine duty; nor do I see any grounds, beyond the region of traditional prejudice, for supposing a naval Officer cannot be rendered capable of performing a Marine Officer's duty ashore.

If a gunnery-lieutenant of the Royal Navy is, by Her Majesty's regulations, eligible, *as he is*, for permanent appointment as Adjutant of a Volunteer corps, why is he not considered competent and capable of performing the ordinary duty of a Marine Officer ashore? And why, as a consequence, should purely military Officers of a high order be condemned, by the nature of their service, to inactivity in a naval auxiliary force when that class of Officer is urgently needed elsewhere, while naval Officers are condemned to half-pay inactivity and civil life during a large portion of their career, because it is assumed to be necessary to officer the naval auxiliary body with military instead of naval Officers?

So long as the Officers of the naval auxiliary force are not a reserve of officers available for naval duty afloat, so long is that body a failure in its most important feature.

The gallant General who raises the question, is himself an example of the evil results of the existing constitution of the naval auxiliary force. With all his experience and all his distinguished service, and though on the "active list" of the forces, the Army can make no use of his talents, because he belongs to the Navy; while the Navy could not find work for him, because he is not a naval Officer, and is not available or capable of performing any naval duty afloat.

He no doubt will tell the meeting that when he served afloat, he did nothing that a naval Officer could not have done, and I would ask him to state, for the sake of proving or disproving my argument, whether any duty he ever had to perform on shore, at home or abroad, might not have been performed by a naval Officer of his own standing, supposing that naval Officer to have had two or three years in barracks under the same laws and regulations as he himself has served under?

Captain COLOMB: So much for my brother's ideas on the subject, for which of course I am in no degree answerable. I, however, think the "young Navy" has to defend itself from the charge of attacking the Marines and the Marine Artillery. Of course, when a naval Officer gets up and says that he thinks the Marines ought to be disembarked in time of peace, there is a feeling in the listener's mind that he has some hidden prejudice against that force. Now, the idea has arisen in my own mind, and as far as I can judge, in the minds of my own contemporaries, entirely out of sympathy with the Marines, and especially with the Marine Artillery, for there is the strongest possible sympathy between the Navy, the Marines, and the Marine Artillery. The Navy has not been able to bear looking at the highly-educated Officers of this force coming on board and being condemned to that terrible state of inactivity and idleness which is their lot at present. It is that circumstance in the first instance which has caused naval Officers to feel it necessary to inquire into this state of things. General Schomberg says a reserve of 14,000 men could not be dispensed with in such a crisis as he describes. I think we should all say "decidedly not." The very last thing we think of is, the dispensing with the services of the Marines and Marine Artillery. What we want to do, is to make them a reserve. They are at present merely an auxiliary. We want to keep them, but we want to keep them as a reserve, in order that when war breaks out, they may come and take their places on board our ships, where they will have real work to do, displacing a certain number of blue jackets of that ship, who will go to form the crew of a second ship. General Schomberg says, "The conduct and behaviour of Marines afloat have of late been severely attacked by many naval Officers." I am not cognisant myself of these severe attacks. (General SCHOMBERG: I am.) In general conversation I hear only one fault ascribed to the conduct of the Marines; that is, that they are very fond of the shore. I have heard no other objections made to them whatever. My own experience goes to show that they are quite as well behaved as the rest of the ship's company; perhaps no better, perhaps no worse. The General quotes these words from my brother's paper: "The Marine Infantry would gradually cease to exist; the Marine Artillery would 'in like manner be absorbed in the Navy proper.'" The words are in inverted

commas, and I presume they are somewhere in the paper; but I take upon myself to believe that they are in a connection which alters the sense in which they appear as General Schomberg has quoted them. Because, as I understand my brother's idea, it is quite the reverse of that; he has no sort of notion of destroying the Marines in any way. But the great difficulty that we have had to contend with in contemplating this question of the Marines as an auxiliary force is, that their primary duty on board ship is for landing. Their military training is entirely to enable them to be landed, and to do the land work efficiently. We cannot forget that ever since 1857, whenever there has been landing to be done, the Marines, as a rule, have been kept on board the ship, and the blue jacket has been landed. It is impossible to say on the face of that evidence that the blue jacket is not efficient when landed. General Schomberg will probably argue that this was an improper state of affairs, that the Marines ought to have been landed, and the blue jacket ought to have been kept in his proper place on board ship. But I, on my part, know no power which would bring about what the General would call that desirable state of affairs. It would be impossible to issue orders to the Commander-in-Chief on any station, and to say to him, "You shall land your Marines, and you shall not 'land your blue jackets,'" because he will use that kind of force which he thinks best adapted.

General SCHOMBERG: To what portion of my paper are you alluding?

Captain COLOMB: I am not alluding to any particular part of your paper, but to the general question. I find it is written, "It is not a time to halt between two 'opinions; such halting and hesitation I believe to be causing mischief to one 'service, and ruining the auxiliary one.'" I agree with that; I think it is not a time to halt between two opinions; but, at the same time, whether we take the view that General Schomberg would have us take, or whether we take the view that I and the "Young Navy" take, either view is capable of a great deal of argument; the question is a very difficult one. There is no doubt whatever that the relations between the Navy and the Marine forces have come to such a pass that they ought to be closely and carefully examined; and, whatever the arrangements might be ultimately, nothing should be done in a hurry: we should not rush to disestablishment without due consideration. If I were to express my own vague thoughts of what might be done efficiently, it would be something of a reorganisation of the Marine service, possibly a larger disembarkation of them in peace time, less of the military training, more of a sailor's training; and I am afraid I should disestablish the Marine Officers, and officer the Marines by sailors.

Commander GILMORE, R.N.: I have listened with much pleasure to General Schomberg's paper, because he agrees very much with my own ideas on the subject. It may not be uninteresting at this moment to give you a short sketch of the history of the Royal Marines from the time of their first embodiment. In 1670, or thereabouts, Charles the Second enrolled a regiment of Marines; it consisted of twelve companies. They continued through the reigns of Charles the Second and James the Second until William the Third came to the throne. He disembodied them, not because he doubted their efficiency, but because he doubted their loyalty to him, thinking that under the previous monarchs they might have imbibed Papistical and Jacobinical ideas. But he immediately afterwards enrolled 3,000 Marines on the same terms as before. When Queen Anne came to the throne she increased the Marines by making the 30th, 31st, and 32nd Regiments Marines. In her reign the Marines made their first mark in history. When Sir George Rooke and Sir Cloudesley Shovel were in the Mediterranean, they were disappointed in their naval engagements, and thought they would make amends by attacking Gibraltar. They first silenced the lower tier of batteries, then the Marines landed, and with the blue jackets they took redoubt after redoubt, until they had captured the whole of the rock, and before evening England's flag floated proudly over it. King William the Fourth gave the corps the name of the Royal Marines. I do not suppose if the Navy were reorganized, and a sudden demand were made for men, that we should get better men than we had twenty years ago, and then we had the Marines at our back. I remember a mutiny on board a ship I belonged to; I will not mention its name. The first notification of that mutiny taking place was the Marines coming up

on deck and falling-in with their muskets. The sergeant-major said, "Marines, you have never failed in your duty, take your arms and go on deck," and up they came. If the Marine Officer is to be disembarked in peace time, and embarked in war time, where is he to gain his experience? Then, the ships of the present day carry heavy ordnance, and although people say the guns are worked by machinery, still it is very heavy work to work the winches, and it requires weight and muscle. Sailors go to sea as boys, and no article of war can make them grow to any greater size than nature intends them to. But Marines are not entered until they get to a certain mature age and certain stature, and they are therefore bound to be as a rule heavier than the seamen; so they are better able to work these heavy guns. It is said in the case of war we could easily increase the number of our sailors, but any person here who has seen the accounts given of the merchant seamen will find that more than one-third of our merchant seamen are composed of foreigners, and the English seamen on board our merchant ships are so deteriorated, that little trust can be put in them. Owners would sooner have one man-of-war's man on board than two merchant seamen. Then, again, we must have Marines on board ship for landing, as our naval operations of late have mostly (to use an Irishism) consisted of actions on shore, and although the naval battalions may be drilled and trained, they can never get the same experience as Marines regularly trained and exercised on shore. Again, when a ship is put in commission, Marines are always at hand and are taken on board before the blue jackets. In one or two ships that I have joined, before the blue jackets went on board, the Marine Artillery were hard at work turning in the lower rigging, and doing a great deal of the seamen's duty before the seamen actually came on board. I believe Lord Nelson was the first Officer who advocated Marine Artillery, and I am sure we cannot have a better opinion than his. After his time Sir Pulteney Malcolm organised the Marine Artillery as they now exist. If Marine Officers are not to be embarked in peace time, how are they to acquire the knowledge of the duties of men-of-war in war time? It is said in some few ships gunnery instruction is turned over to the Marine Artillery. My opinion is, that all Marines should be Marine Artillery. It is rather an invidious distinction that the Marine Artillery should receive a different rate of pay, a different class of promotion from the Marines, although when embarked both forces do the same duties. Educate the Marines up to the Royal Naval Artillery standard. Often as a Gunnery-Lieutenant myself, I have drilled the Marines against the blue jackets, and the Marines ran the blue jackets very close indeed. In the scale that General Schomberg has given of the instruction of the Marine Artillery, the instruction they undergo is far superior to the instruction of the garrison and Royal Artillery. Captain Goodenough says there will be no occasion to have any large body of Marines as a reserve. Officers before my time will remember, and I have heard it said, that when the "Trafalgar" was commissioned, the blue jackets would not join the ship, and 400 Marines had to be sent on board before that ship could start on her cruise. It is not many years ago, in 1858, when we had to go into the by-ways and slums to get any specimens of humanity to go on board ship. In all cases of sudden emergency, we should have to do the same again, unless we had a reserve of Marines to go on board and do the duties of Marines, and partly those of seamen also. Now-a-days we do not require the same amount of actual seamanship in the blue jackets, although we require a great amount of skill in the Officers to manœuvre the ships. I think when we have a body of men on shore as a reserve like the Marines, we could distribute our seamen over more ships and fill up the gaps with the Marines. As Captain Goodenough says, there is now a number of blue jackets in the ports who are not on board ships, but resting in barracks. Still it is merely a question for the Admiralty whether these men should be allowed to stroll about the dockyards doing shore work; or, whether they should be on board and rendered capable of being of service as seamen. In case of sudden war, we require sudden expansion. Our next war would be probably against Russia, Prussia, and America; and in that case we could not call on the Naval Reserve, for calling would be of no avail; but must come upon our Marines and blue jackets, and so be ready to strike the first blow.

Rear-Admiral SHADWELL after briefly stating that his presence at the meeting

that evening was quite accidental, and that he had not come prepared to take part formally in the discussion, observed that he was, notwithstanding, desirous of making a few observations on the question before the meeting, but proposed to confine himself chiefly to the main inquiry proposed for discussion, "Are the Royal Marine forces under present circumstances a necessary auxiliary to the Royal Navy?"

To this query he (Admiral Shadwell) had no hesitation in at once replying most decidedly in the affirmative. It had been his lot to take part during a rather long service in various parts of the world, in Syria, in Burmah, and in China, in several of the "small wars" in which it was the fate of this country to find itself so frequently involved, and he had therefore had ample opportunity of witnessing the great efficiency of the Royal Marine forces in all hostile coast operations.

It was no doubt quite true that the drill and organization of the seamen of the Fleet as small arm men, and with field pieces on shore, had received great attention of late years, and had been brought to a comparatively high state of perfection, but still the speaker held that their efficiency and steadiness in actual service would always be, from the very nature and character of sailors, far inferior to that of a regularly-trained military force like the Royal Marine Corps. The true way of utilising the services of seamen on shore in warlike operations was that adopted by the late gallant and lamented Sir William Peel—attach the seamen to big guns; they were excellent artillerymen, and thoroughly understood how to handle them, and they must then be steady, and when so employed, would always be a valuable addition to an expeditionary force, but in their employment as small arm men, or light infantry or otherwise, the speaker had but little confidence.

With reference to what had been stated as to dispensing with the services of the Marines, and substituting for them an equivalent number of seamen, it must be remembered that the force was a popular force, easily recruited and raised to any required standard. While the additional 20,000 men voted by Parliament last year for the augmentation of the Army, on the outbreak of the late war, had not yet been obtained, and while it was lately stated on authority in the House of Commons that the Admiralty had not succeeded in raising from the merchant service 450 extra seamen required for the Fleet, no difficulty was experienced in obtaining any required number of young men for the Royal Marine Light Infantry Corps.

Recruits for this service tapped a different stratum of the population from that which supplied boys destined to become seamen for the Royal Navy. Many a young fellow desirous of seeing a little of the world, who had not had opportunity of entering the Navy as a boy, or who had become too old, or had missed his chance, could gratify his wishes by enlisting in the Marines, and the speaker believed he was quite correct in stating that no difficulty was experienced in obtaining, at all times, eligible recruits for this branch of the service in the western and midland counties, and in the manufacturing districts.

As to what had been mentioned relative to the enforced idleness of the young Officers of Marines, when serving afloat, Admiral Shadwell thought that that was much to be regretted, and that it was highly desirable that measures should be devised for utilising their energies and abilities more systematically for the benefit of the Service, and he did not see any great difficulty in carrying this reform into execution.

In conclusion, he begged emphatically to repeat that so far from acquiescing in any feeling of indifference towards the service of the Royal Marines, he would far rather see the force doubled than reduced by a single thousand, and he trusted that the Royal Marine force might long continue to form a component part of Her Majesty's naval forces, as a valuable auxiliary to the Fleet.

Captain GARDNER, R.N.: I rise to correct a statement made by Captain Gilmore. He has stated here to-night that one-third of the seamen employed in our mercantile marine are foreigners. Now, I will refer him to the *Nautical Magazine* of last month, in which he will find, and I have very good authority for saying that the return there is correct, that there are upwards of 228,000 British seamen now employed in manning our mercantile marine, and there are rather more than 20,000 foreigners, which is considerably less than one-third. I should also like to ask Captain Goodenough one question. If he does away with the Marines, to what extent is our

standing Navy to be increased, and to what extent is the Reserve of regular men-of-war's men to be increased? Because, if the Marines are removed from their naval duties afloat, there are 14,000 men done away with; and we must increase the Navy with 14,000 seamen to fill up that gap, and we must also increase the number of our boys in the training ships to a very great extent, to allow for the additional waste. Then I want to know where the Reserve is to come from? Because at present we may say that we have no Reserve of men-of-war's men outside the Navy, except the pensioners.

Captain GILMORE: Will you allow me to reply to Captain Gardner? The foreigners employed in our merchant Navy are employed in the foreign-going ships. The coasting trade employs no foreigners at all.

Captain DAWSON, R.N.: I believe that nine naval Officers out of ten would be prepared to endorse the statements made by General Schomberg to-night, with reference to the Royal Marines; and I am one of the nine, and not the odd tenth. Under these circumstances I have very little to say about the paper, further than that I think it would be well to analyse our own minds, and ask why it is that we naval men have such love for the Royal Marines? and what it is we want them for? First of all, we want them for landing. I agree with Admiral Shadwell, that sailors cannot become infantry soldiers, for the principal reason that their Officers do not understand the military art. Our gunnery lieutenants may be very good drill sergeants, capable of managing battalions on the parade ground, but that is only the alphabet of the military art. I wish to state that as clearly and distinctly as possible, so that our naval brethren may not be carried away with the notion that a smattering of mere drill fits them for military command in war. The embarkation of Marines for sea-service is simply a question of discipline. They are not wanted for small-arm practice on shipboard, because in firing through ports our own men make quite as good practice. And with regard to the working of artillery, I quite disagree with what has fallen from some speakers. The best practical artillerymen in the world are, and always will be, seamen; whether of artillery worked on shipboard, or artillery worked on dry land. We desire to have the presence of Marines, simply as a question of discipline, and when the Naval force is expanded to meet the exigencies of a maritime war, this will be still more keenly felt. How in the world is it that Marine Officers, with raw material not a bit better than ours, turn out such trustworthy men as their non-commissioned Officers, whilst naval Officers cannot do the same thing with their petty Officers? Why should it be so that on shipboard, naval Officers trust, respect, and almost reverence the sergeants of Marines, and yet cannot place similar trust in their own petty Officers? Simply because of the different treatment to which they are subjected. If the petty Officer in the Navy were treated in the same manner as the non-commissioned Officer of Marines, he might be worked up to the same point of respectability, of trustworthiness, and of discipline. The fact is, naval Officers have a very loose notion of discipline, especially of that chain of graduated authority which descends from one subordinate to another. The non-commissioned Officer of Marines superintends such daily routine operations as washing and cleaning up the barrack-room, &c. He reports to the subaltern, who inspects them, and reports to the captain of the day, who again inspects and reports to the field Officer. Whereas in some ships we will not trust the petty Officer, or the subordinate Officer, and we hardly trust the lieutenant to superintend the corresponding operation of washing decks, but the captain himself must see it done. How can the chain of subordinate responsibility be preserved if we will not trust Officers and petty Officers, but the highest Officer must always be personally doing the work which a petty Officer should be entrusted with? In one ship where responsibility and trust were confided in the petty Officers, and where the crew were made to salute naval and military Officers on shore, those petty Officers could be trusted to report any seamen neglecting to salute, or found in improper uniform on shore—to exercise, in fact, the same authority as is confided to the non-commissioned Officer of Marines. If the system prevailed more generally of reposing trust in the petty Officers, and separating and distinguishing them, instead of treating them as ordinary seamen in disguise, you would have a class of petty Officers quite equal to the non-commissioned Officers of Marines for trustworthiness and

discipline. Another point. It is generally found when the Marines are disembarked, at the end of a ship's commission, that they have suffered in discipline; and it is the first care of their Officers during the time they are in barracks to work them up again to their natural standard of implicit obedience and discipline. What happens to the blue jackets in like case? Instead of the time when the blue jackets are in the dépôts, being similarly seized upon to work them up to a higher standard of discipline, that is the very time that it is thrown to the winds. Whilst the Marines are undergoing a regular course of disciplinary training in barracks, seamen awaiting ships are employed as coal-heavers, or doing convicts' work in the dockyards, to the destruction of all efficiency. Opportunity should be taken of the three, six, or nine months in the dépôts, to train them up to a higher standard of obedience and orderly conduct, with a view to discipline, than is always possible at sea. Half the training done in the Marine barrack yard is really tending to discipline, having for its direct object subordination and good order, far more than the mere polishing and handling of weapons. But the naval Officer has very little notion of that. To teach seamen the use of their weapon is his one idea, not the inculcation of subordination and habits of discipline. There is some difficulty in doing all that is desirable on board dépôt ships. But if we had barracks we should not know how to profit by them as Marine Officers do. The great reason, then, why we want Marines embarked is because they possess a severe order of discipline; but why should not naval men take a leaf out of the book of the Marines, and try to raise their own men to the same standard of obedience and subordination which exists in that distinguished corps? As to officering the Marines from the Navy, I should fear lest the discipline of that force might be brought down to that of our own, rather than ours raised to the standard of the Marines. I do not quite agree with a previous speaker, that the Marines should be altogether landed, because how, then, are soldiers to become Marines? How are they to become sea soldiers? How are they to get their sea legs and sea stomachs? How are they to learn those seamanlike handicrafts which Captain Gilmore tells us they can do, when a ship is commissioned in time of war with riff-raff crews and no seamen on board, namely, turn in the rigging, &c., &c., if they have never had the opportunity of going afloat? The difficulty is, how to give Marines sufficient sea training, and at the same time to rear up that increased force of seamen we could employ if the Marines were landed in time of peace, and their places filled up with blue jackets? There are difficulties on both sides. It would be a great gain to have a larger number of seamen under training. It is the old case of the short blanket, if you pull it up over your shoulders, you uncover your feet, and if you pull it down over your feet, you uncover your shoulders. I must confess that whilst I am in favour of most that has fallen from General Schomberg, I think we might meet the difficulty by a compromise; that is, reduce very considerably the number of Marines embarked, and be content with a shorter period of sea training.

Rear-Admiral CAMPBELL, C.B.: I dare say there are many Officers present who may call to mind in 1859 a number of line-of-battle ships were commissioned in expectation of a rupture with France. On that occasion (to the best of my recollection) ten or twelve ships were commissioned, and many Officers present may remember the style of bounty men we entered for those ships—a few good, some bad, and many worse. I was not in England at the time, but was appointed to the command of one of those ships shortly afterwards at Gibraltar. On joining she had about 880 men, and I think I am right in saying that between 700 and 800 of her complement *never* had their foot on board a man-of-war before. I was told by several of the Officers of those ships that the whole of the gun gear was fitted and the lower rigging turned in principally by the Marine Artillery and Marines, whose services were invaluable, for the ships were some time in getting manned.

I beg to mention what a very distinguished French Admiral said to me not many years ago in the Mediterranean. He said, "You have the advantage over us in two 'things in your profession, viz., in having Marines and in having masters." Now both of these advantages we appear to be desirous of ignoring. I only hope it will not take place in our day, at all events.

Captain BALFOUR, R.M.: At this late hour of the evening I would only make

two remarks. One is to refer to the Committee on the Manning of the Navy, which sat at the time when Sir James Graham was First Lord of the Admiralty. I was informed by Sir Peter Richards, and I do not think there could be much better authority, that after the Committee had sat from October until March of the following year, and they had embraced all the strong points in their inquiry, the Committee recommended that the Marines should not be reduced by any means whatever, but that they ought rather to be increased. Reverting to former wars, I think in the war with America, which was the one, perhaps, in which we were most tried, the Marines, who had been decreased to about 9,000 men, were rapidly increased, until they amounted to 30,000. In the war with Russia, when our Coast Guard was in a very different state from what it is now, with no Naval Reserve of any kind, I remember being on Admiral Chad's ship when signal was made to "loose sails." On going aloft, one man in particular said he could not go so far. Many of them went up a few ratlins. One fellow I think had gone up two ratlins when he said, "I'm so blowed I can't go no further." Admiral Sir Charles Napier made the well-known signal among others—"What is the efficiency of the men and Officers in 'gunnery'?" Sir Henry Keppel was one who replied, after some little time, "Progressing." The truth of it is, the men knew nothing about it, and they were obliged to be instructed by the Officers. In the ship I was in, 100 of the men were Irishmen from the coast of Connemara; they really could not speak English. The Marines, in fact, were the principal strength of the Fleet. With these facts before me, I say we want, and must have, a really good standing Reserve of Marines.

Captain STUDDERT, late R.M.A.: I came here to listen to a paper by my old friend and Commanding Officer, General Schomberg, and I have been very pleased with it. I did not intend to make any remarks, but some remarks have been made that compel me to do so. In 1857 I had the honour to embark on board Her Majesty's ship "Shannon," in a passage to China, under Captain Peel, afterwards Sir William Peel. The Russian war had just come to an end. It was not a war in which the Navy, as a Navy, had taken any very great part, that is on board ship. No vessels had been sunk in action, no desperate engagement had taken place either by single ships or by fleets. The seamen had to go on shore to distinguish themselves; and when they did go on shore they did distinguish themselves, that we all know. We did not lose many seamen by casualties in war or disease. There was no reason why, in 1857, a ship bearing the name of the "Shannon" ought not to have been manned by the *élite* of the seamen in the service. But what was the fact? A telegram came down from the Commanding Officer directing a detachment of Marines and Artillery Officers to embark. In four hours we were on board the "Shannon." During the passage to China it was discovered that we had a most inferior crew as far as the seamen were concerned, and that it consisted of much of the refuse that had been hanging about the "Hard" and elsewhere. Fortunately the ship was commanded by Captain William Peel, a name that can never be mentioned before naval or Marine Officers without a feeling of sorrow at his untimely end, and a feeling of pride in such a man. Fortunately she was commanded by him and a most efficient class of Officers, and the men with the greatest care and attention during a long voyage were brought to a state of discipline and to some degree of knowledge in their duties. I was embarked as a supernumerary Marine Artillery Officer, and I was called upon during the voyage to assist in carrying on the gunnery duties of the ship. Also, the non-commissioned Officers that I had with me of the supernumerary detachment who were competent to do so, were employed in giving instruction to the crew. The Officers worked as hard as they could, and the result was shown in India afterwards, when the men landed and established a naval reputation by their advance upon Lucknow and their proceedings there. On the voyage out, in a gale of wind off the Cape, the men were ordered to go aloft and reef topsails. A number of the sailors were afraid to go. Sir William Peel punished them by having a piece of canvas placed across their breast when they went to quarters abaft the mizen mast, with "Skulking in going aloft in a breeze." And these were seamen we should have had to rely upon in an emergency. What was the conduct of the Marines on board? Captain Peel placed the utmost confidence in them, and on leaving the "Shannon" at Hong Kong, he thanked the detachment on the quarter-

deck for the example it had shown the ship's company, and for the assistance the non-commissioned Officers had given the gunnery staff on board. He had all hands on deck, and they heartily cheered us as with heavy hearts we left the old ship for the gunboat alongside. I merely mention this case as showing that the Marine Artillery and the Marines are there when called upon. Why, then, without very mature consideration, advocate their disbandment to any extent whatever? If it can be shown that a better system is established, and that seamen can do the duties that have been done by the Marines, by all means adopt it; we shall all be delighted. I am unfortunately on half-pay, and shall have no further connection with the Marine Artillery, and I can speak dispassionately about them. Still the conclusions I come to may be of the more value because they are totally disinterested. At that time I never realised so much the value of the Marine force as an auxiliary to the Navy, and I have ever since dwelt upon the advantage of it as such, because they were so prominently brought before me. I had no intention of making any remark, but allow me to read a paragraph in a letter which I wrote some years ago, and which I think is applicable to the present case. Earl St. Vincent spoke of the Marines in these terms:—"There never was an appeal made to them for honour, courage, and loyalty that they did not more than realise my highest expectations; and if ever the hour of real danger should come to England, the Marines will be found the country's sheet anchor."

Admiral of the Fleet Sir GEORGE SARTORIUS, K.C.B.: I have listened with a great deal of interest to what has been said on both sides, but I confess that I still retain the opinion that I have always had, that the Marine force as hitherto existing is a most valuable force, and that the time has not yet arrived when any important change can be safely made in it.

We have forgotten that it was to the actual constitution of the Marine forces that we owe the salvation of our Fleets in the great mutinies at the conclusion of the last century. I can personally bear testimony to a similar good service rendered by the Marines on board of the "Tonnant" 80-gun ship. The discipline was excessively severe on board of her, and in consequence an alarming and extensive mutiny was got up amongst the blue jackets. At night information was given to the Captain that the intention of the mutineers was to murder the obnoxious Officers, and then to carry the ship into a French port.

The Marines were immediately placed quietly under arms, and parties from all the Officers told off, accompanied by non-commissioned Officers of Marines, went below and arrested the chiefs, about thirty, the rest alarmed at the sudden attack, and not knowing how many traitors might be found amongst them, remained quiet, and thus by the invaluable support of the Marines, and the pluck and firmness of the Captain and Officers, the ship was saved.

It was a wise policy that had been always pursued with regard to the Marines, to keep them as much detached as possible from their sailor shipmates, even to the extent of discouraging the Marines from performing sailors' duties, and thus arose an antagonistic feeling between the two parties, which has enabled the Officers to obtain from the former such wholly important aid in moments of great danger. A great deal has been said about the utility of making the Marines act as sailors. I think it is a doubtful compliment to call a Marine a good sailor. He can hardly be a first-rate sailor and a first-rate Marine.

It is as a soldier that a Marine is of real value. It is impossible that a sailor with his many and special duties can become as good a soldier as the man who is exclusively brought up as a military man. Then there is another important consideration, with the changes that are constantly taking place, and the discoveries and inventions that are springing up so rapidly, I think the time is not far off when some motive power is likely to become known which will render masts and sails quite superfluous. In that case the Marine will become of more service than the sailor, particularly the Artillery Marine.

I do not see why the whole service (Marine) should not be Artillery. Captain Dawson spoke of the sailor artillery man being the most perfect for sea service. He may be quite right there, but he must recollect that at the end of three or four years, when his ship is paid off, you lose him, but the Marine Artilleryman remains.

With our vast possessions abroad we shall always need strong bodies of soldiers for disembarkation; these (the Marines) landing with the partially-disciplined sailors would form a useful and formidable force. But I do not think the sailor alone can ever have sufficient military discipline to act independently; but it is necessary the more skilled should accompany the less skilled. I cannot help thinking, therefore, that such considerations are too important to justify making any change in the actual organization of the Marine force. The interest I have always felt in the Marines, and the importance I have always attached to the Marine Corps for the good of the Navy, still have a strong influence with me.

General SCHOMBERG: First, I have to thank the audience for the kind attention they have given to my paper. I have also to thank those who oppose my views, for the courteous way in which they have stated their objections. Captain Goodenough's first objection is to separate training. As regards separate training, I do not know that there is a much greater difference than exists in the training in two different ships. There is separate training, and we have always been taught in days gone by that Marines and seamen should be kept rather apart. The Marines have always messed together, and their training has been rather distinct; but the two forces have been brought more together now, and their training is more uniform. I do not think this *inconvenience*, if it be one, would be a serious objection to the Marine forces continuing in existence. I now turn to his last objection, which it will be more convenient to deal with now, that the Marines are under two disciplines. It is certainly a very great trial to the men, as I have mentioned in my paper. But they are enlisted and trained to serve under military and naval discipline. After their first embarkation, they understand perfectly well what naval discipline is, as well as marine discipline, and get easily accustomed to both systems. I think if Officers (Naval and Marine) exercise discretion and judgment, and endeavour to support discipline, this objection vanishes, and that the two services can work perfectly well together. With regard to the proportion of Marines to seamen, that I think may require adjustment. I bow to the necessity of training as many sailors as possible. To ensure the training of Marines for service afloat it may be necessary to embark them in large numbers in the summer, for special instruction in their duties at sea. As to the question of the blue jackets being capable of performing Marine duty, and whether a ship can be efficient without Marines, I think the experiment should be tried. I daresay Captain Goodenough and myself would differ in our views as to the mode of carrying out the experiment. He might probably suggest to fit out a ship carefully manned with a selected crew, and send her to sea without Marines. My idea would be to disembark Marines, artillery and infantry, from the Channel Fleet, and send the Fleet to sea the week afterwards. Something between our views would probably be the correct thing. The question of the capability of the blue jacket to take sentry duty is a question of discipline. What is discipline? Discipline is a thing of very slow growth. Captain Dawson hit it off very happily in calling it a chain of duties, care about trifles, even to pipe-clay and cleaning boots; exacting the most scrupulous cleanliness from the men, from head to heel, under all circumstances; the utmost precision in drill. It is this attention to *minutiae* which is the secret of discipline. But whether sailors, as they are now disciplined, could take the duty of sentries remains to be proved, and I think it should be proved. I should like to say a word about the discipline of highly educated soldiers and sailors. No one is a stronger supporter of education than I am, but with a force of highly-educated men in the ranks, I am convinced you must have an iron discipline. Your discipline must be most severe, but it must be most thoughtful and most consistent. You must educate your Officers in discipline and administering discipline, which is the most difficult duty an Officer has to perform. I think the power to punish should be transmitted down the Navy as it is down the Army, that the chain of duty in this respect should descend, so that every Officer, from the rank of captain of company, should have the power to administer a certain amount of punishment, as in the Marines serving on shore. That would teach Officers the difficult question of administering discipline. If you attempt to train educated men without a most severe discipline, your training will break down.

Captain Colomb's first objection is, that participation in duty of Naval Officers is sacrificed by the existence of Marines. But if Marines be necessary, employment and participation in duty is as necessary to their Officers as to Officers of the Navy. If we be not useful let us go; we are unwilling to exist as a sham. If we are useful, keep us. As to the anomaly of our position, is there anything in England not anomalous? Is not the English constitution anomalous? I believe the Marine is as much a part of the strength of the Navy of England as the sailor himself; he is as much a man, *per se*, as the sailor. He is under peculiar discipline; he is the only man who comes under two disciplines; he is always to be depended upon. The Marine force is peculiar to England; one of the many anomalies that constitute its strength.

With regard to duty when embarked, I think many duties might be given to Officers and men. Of course, we all know that the labour of both soldiers and sailors is labour lost in peace; unhappily, there is now more than ever a necessity for that loss.

There is always a waste of labour in peace in training men for war. Captain Colomb asks me whether any naval Officer could not have performed the same duties that I have performed? Had the naval Officer been trained as I was, I daresay he could; and if I had been taught I could have kept watch on deck, and performed the duties of a sailor. But no average man can be soldier and sailor. As far as soldiering is concerned, I have been learning soldiering all my life, and am still learning it. I do not think you can train or mould men or matter to two trades, or two different ends. Lately we tried to construct a ship which should be a cruiser and a floating battery, and that ended in disaster. You cannot get a horse to be racer, cart-horse, and hack. Neither can you get a man to be a soldier and a sailor. Captain Dawson says naval gunners are the best gunners in the world. Every man for his own trade; and naval gunners are, as they ought to be, good; but at Eastney, the Marine Artillery would, I dare say, contest the point of superiority with him. I am very much obliged to him for the compliment which he pays to our discipline; such praise is certainly refreshing. I quite agree with Sir George Sartorius, that Marines should be soldiers most carefully trained. I think all ideas of looseness in drill, of which we heard a good deal some time ago, have been driven out by the Prussian war. I never held the opinion myself that drill or discipline should be loose. No men have rougher work, perhaps, than Marine Artillery, and no men are more strictly and accurately drilled. The Prussians understand this, who constantly put their old soldiers to recruit and marching drill, in the midst of the hard work of a campaign. The rougher the work, the more strict and precise should be the drill.

The CHAIRMAN: Before asking you to return your thanks to General Schomberg, I should like to make one or two observations upon the paper. The question seems to me to have been very well argued out on both sides. We have heard a great deal that to me is new and very interesting. There is no doubt much to be said on one side, and something on the other. We have been invited by General Schomberg to express our opinion as to whether the Marines should be retained on board or not. Very few naval Officers (only two) have spoken out positively for, and a great many against the change. I am one of those who do not see my way to parting with the Marines. I should be very sorry to part with them. I have lived long enough in the profession to know their great value. Since the system of having "continuous service seamen" was adopted, the necessity of commissioning and fitting out ships for a long time with Marines alone, exists no longer. When a ship was commissioned 20 years ago, the first thing we did was to "draw" the Marines, this brought from 150 or 200 Marines on board a line-of-battle ship to do the work of the ship, perhaps for a month or so, until we could get the seamen on board, but now that we have the "continuous service seamen," we should not feel the want of the Marines as we used to do in the early stage of a commission. Although that necessity is gone, I do not in the least degree see the advisability of parting with the corps of Marines from on board our ships, but that is a very mild way of stating my opinion, which is, that I consider that it would be most mischievous to part with them, or to allow it to be supposed that the force was likely to be materially changed in its character or further reduced in numbers. Remarks have been made

on the few duties which the Marine Officer has to perform on board. I am of opinion that if they were properly encouraged by the authorities, Marine Officers might and would become the Officers of highest professional culture in the Navy. It was intended by Mr. Childers, as far as I could gather his intentions, to reduce the list of executive naval Officers, and especially the Lieutenants, to the smallest possible numbers, so that all of them should be almost constantly employed in peace time on active service *afloat*, instead of maintaining, as he should have done, a list of Lieutenants (probably one-fourth more than required for active service) in peace time, which fourth would be allowed to remain on shore one year out of four if they proved at short intervals that they were following some useful professional study. As far as I can see, the naval Lieutenants under Mr. Childers's arrangements, are likely to get very few opportunities of studying and making themselves men of culture. As regards professional accomplishments and languages, &c., the Marine Officer, however, would have time to study when ashore in barracks and also when *afloat*, if he were encouraged to do so. I am alluding only to those branches of knowledge which would be thoroughly useful professionally. As a professional man, therefore, the Marine Officer might be the most cultivated man on board ship in all these branches of knowledge. There is plenty of occupation for him in this way, and he will avail himself of it if only he has proper opportunities and receives sufficient encouragement. We should then have two or three Officers on board our larger ships, and one in each corvette, who would be most invaluable as military engineers and surveyors, as linguists, meteorologists, photographers, &c. To illustrate what Marine Officers can do even without inducement, I may mention that the Marine Officers who have gone to the Military Staff College, have specially distinguished themselves, and taken places equal to and above Officers of the Line; they have done this, remember, without any prospect of reward for doing it, simply from love of and desire to acquire knowledge. The necessarily unemployed time of the Marine Officer has never been properly utilized, and yet it might be most beneficially in various ways. We have heard a great deal about the Naval Reserves to-night. Of course, a Marine force of 14,000, of whom 7,000 are on board, and 7,000 are on shore is, as regards the men ashore, a large and invaluable Reserve. We have other Reserves, viz., the Coast Guard, the Royal Naval Reserve, and the Naval Coast Volunteers. The Royal Naval Reserve is considered by many people, myself among the number (I commanded the force for three years), to be our most valuable naval Reserve of seamen next to the Coast Guard. I maintain that the Royal Naval Reserve, about 15,000 in number, is an invaluable body of men; that they *are* to be depended upon; that you *will* find them when you want them; and that nothing ought in common fairness to be said against that force. It was proposed in the paper read here some nights ago by Captain Colomb, that the Marines should be disembarked from the ships and sent to the colonies, and that sailors should fill up the vacancies in the ships. Now, if we had sailors to take those vacancies, viz., 14,000 additional seamen, 7,000 of them to replace the Marines *afloat*, and 7,000 to replace those in barracks, there might be something in the proposal. I quite agree with Captain Goodenough that there are some arguments, but not in my opinion of sufficient weight, for having seamen, and only seamen, on board ships in peace time, provided you can have an additional reserve (7,000 men) to replace the 7,000 Marines in barracks. But I want to know where these 14,000 seamen are to come from. It would take five or six years to make them, and you would have to enter this year about 18,000 boys in addition to the 2,000 we generally enter, to provide in 1876-77, the 14,000 additional seamen to replace the 14,000 disbanded or disposed of Marines. If we were to land the 7,000 Marines that are *afloat* now, there would be no seamen to be put in their places; but this is what would be done if the 7,000 Marines were disembarked as proposed. A certain number of ships would be paid off, perhaps one-third of those in commission. The blue jackets so made available would be distributed to fill up the vacancies in the ships remaining in commission, from which the Marines had been landed, and we should be no better off for seamen than we are now, but should have reduced our fleet to two-thirds its numbers and strength. It takes a boy of sixteen years of age four or five years to become an able seaman. If we very largely increased our number of

training-ships for boys, then in the course of several years we might get a sufficient supply of seamen to replace the 14,000 Marines. When this enormous number of boys, 21,000, required this year has been entered, placed in the training-ships, of which 40 would be required, when they had completed their training, and had in 1876-77 become seamen of 21 to 22 years of age then, and in that year, but not safely before, we could afford to take into consideration the question whether the Marines might not be landed. In the meanwhile, and for many years the ships will have been overcrowded with many thousands of boys and young seamen, to replace the 7,000 Marines who of course would not be landed until the lads were turned into seamen, otherwise the ships' companies would be most improperly weakened, and there would also have been the 7,000 Marines in barracks all the time. If the Marines were ultimately landed and sent to the colonies, after being replaced man for man by a seaman, they would become a kind of colonial *corps*. I do not believe a permanent colonial *corps* is looked upon with a favourable eye by the Army, and the nature of the Marine recruit, now the best article that can be got, would sadly deteriorate. To keep a colonial *corps* as I understand they are to be kept—

Captain COLOMB: The intention is to keep them perpetually changed in small numbers.

The CHAIRMAN: Perpetually changed! that is, ships always coming backwards and forwards, I do not believe that the expense of that would be incurred. You think then that you will thus give them their sea-legs. I do not understand that it is proposed to send them cruising in sea-going ships to retain their sea-legs. But it is proposed to send them to the colonies, that will not give them sea-legs, and they will not be the men they are now. Therefore, I for one do not see my way to follow out the course proposed by Captain Colomb; on the contrary, I think it fraught with mischief. The real way, in my opinion, to look at this question is not from that point of view which leads you to speculate upon whether the composition of an ideal ship's company might or might not be preferably composed of blue jackets rather than of blue jackets and Marines, thus ignoring many important sides of the question, and especially the best composition of the naval reserves, any more than it would be to suggest that a ship's company should be composed entirely of petty officers and leading seamen, with no admixture of A.B.'s, ordinary seamen, and boys, ignoring the question of training. This is to look at the object through the wrong end of the telescope. The authorities ought and must settle on high political grounds, if they wish to put the whole question on its proper footing—(1) How many men with *sea-legs* and *sea-stomachs* would be required in case of a naval war of long continuance, against any probable combination of allied countries? (2) What, in the various description of ships of war, is the average proportion which skilled seamen, who are the most expensive to train, should bear to men having merely great physical force, combined with sea-legs and sea-stomachs? (3) What portion of the large numbers of these two classes that would be required in such a war, ought to be specially trained in peace time by *continuous* practice aloft, and at guns, &c., in the case of the blue jackets, and at guns and military exercises only in the case of the *first* class in men-of-war constantly or frequently cruising at sea. (4) How many of the first of these two classes are receiving their seamanship, sea-leg, and sea-stomach-training at no cost to the country in the merchant service in peace time for 11 months in the year? the remaining portions of both classes being only *periodically* trained, as regards the blue jackets at gun drill, for one month in each year, and as regards the Marines at sea, three years out of six. The number of boys required would be ruled by the pre-ascertained cost and waste of seamen. It is evident that if these four questions are carefully considered and answered, the authorities will be able to decide upon the only remaining open questions, viz.: (a) The amount of tonnage which must be commissioned to exercise the predetermined number of seamen and Marines and boys who are to be constantly employed in peace time afloat, and the amount of barrack room required for those of the *second* class (the Marines) in reserve on shore. (b) The number of seamen, marines, and boys afloat would rule the *minimum* number of Officers required. (c) The nature of the services in which the ships would be employed on foreign stations would rule the *size* and *character* of the ships that had to be commissioned. Other considerations would rule the

numbers actually on the lists, viz., the requisite flow of promotion, the necessity of giving sufficient opportunities to Officers for study on shore in the intervals between active employment, &c., &c. (d) And these total numbers of individuals that have to be embarked, including artificers, when taken into consideration with the nature of the ships required, &c., would rule the *number* of ships of all classes that would have to be commissioned; (e) and thus we should have a peace fleet as efficient as regards the composition of the ships' companies as the circumstances will permit, and this notwithstanding that an Officer might prefer, and justly, to have in any individual ship only petty officers and leading seamen, and another only blue jackets and no Marines. This conclusion, be it observed, is arrived at without taking any account of the Marine's special qualifications as a soldier, but regarding him from the lowest point of view as physically a powerful man with sea-legs and a sea-stomach embarked in a ship that has a sufficient number of skilled seamen to do all their own particular work, but requires the manual labour of a large number of men that need not be seamen. The number of men, blue jackets and marines, employed in peace time, should not therefore, from this broad point of view, be governed merely by what may be just sufficient to make our flag respected, but should be decided on always by war considerations, and those only, although profound peace may reign everywhere.

I quite concur with Admiral Shadwell's view that if the Navy had to depend entirely upon *seamen* as the only component part of a ship's company, now made up of seamen and Marines, the area of recruiting would be most sensibly diminished, and that in these days would be a great loss. To recruit our Royal Navy both as to the active service and the reserve of Marines, we now tap the great reservoir of the population of these islands at two different places. We ask for and can get as many boys as we want to recruit the seaman class; we ask for and can get as many adults as we want to recruit the Marines; and this is another argument for retaining that body. I am afraid also that in the middle of a hot naval war of long duration, when our insufficient seamen reserves were exhausted, and we were driven again to offering bounties, which bring in many bad characters, and perhaps as a last resource have recourse to the press-gang, the Marines, strictly loyal as ever, would again be, if on these grounds alone, an absolute necessity to aid the Officers and well-disposed blue jackets to maintain order and discipline. Depend upon it, the promptitude with which such a body of men, now unfortunately much reduced in number, can be placed on board ship at the outbreak of a naval war is, and will remain one of our best securities for peace. Allow me to return your thanks to General Schomberg.

Ebening Meeting.

Monday, May 1st, 1871.

COLONEL T. ST. LEGER ALCOCK, Vice-President, in the Chair.

NAMES of MEMBERS who joined the Institution between the 24th April and the 1st May, 1871.

LIFE.

Bonhote, John, Ensign 57th Regiment
Boileau, G. W., Lieut.-Colonel 1st City
of Norwich Rifle Volrs.

Gonne, Thomas, Captain 17th Lancers
Browne, James, Major R.E.

THE SWISS MILITARY SYSTEM.

By Messieurs HOTZE and MARTINI.

My much esteemed friend, M. Frederich von Martini, has deputed me to accept on his behalf, or rather to share with him, an invitation from this Institution to give some account of the Swiss military system. We both feel flattered by this invitation, and both of us—he as a naturalized Swiss, and I as a Swiss by birth—take somewhat of a patriotic interest in the subject. It may be well, however, to state at the very outset that we do not propose to make an unqualified eulogium of the military institutions of our country, still less to recommend them for universal imitation. These institutions do not derive their origin from legislative enactments—in fact, the statutory and documentary material available for studying them is singularly scant and meagre; but they are identified with the earliest traditions of the miniature commonwealths which form the Swiss Confederation. They are the expression of a national character which is in many respects peculiar, and in sharp contrast with that of surrounding neighbours. These institutions, moreover, exist and flourish by virtue of social, political, and geographical circumstances, which are not to be found elsewhere in the same, or even analogous conjuncture. The underlying principle of the system—if system it can properly be called—is doubtless a sound one, and one which is susceptible of being applied in many other than the Swiss manner. It is in the more or less judicious manner of this application that the whole question lies, whether or no the military institutions of Switzerland afford a useful model for the reorganization of those of Great Britain.

So much has, especially of late, been written on the subject before

us, that the broad general facts are abundantly familiar. I take it, therefore, that what the members of this Institution are chiefly interested in is the practical every-day working—the inside view, so to say, which can only be obtained by personal observation. This, asking your indulgence in advance for many shortcomings, it will be my endeavour to give.

The liability of every Swiss to military duty, which is a fundamental article of the Swiss Federal Constitution, is not only a duty, but also a privilege. In theory there are virtually no exemptions, but there are some exclusions. No one not in full possession of all his civil rights, as, for instance, through bankruptcy, is eligible to the grade of officer. Any one having undergone an infamating punishment is excluded from the ranks. Formerly, in most or all of the cantons, and I believe in some still to this day, the Jews were, by a remnant of barbarism, under certain civil disqualifications, and therefore exempt, or rather excluded, from military service. In theory, also (I purposely, for the moment, confine myself to the theory of the law, for we shall presently find in the practice some very considerable departures, and even some flagrant contradictions) in theory not only does every able-bodied man owe *wehr-pflicht*, or military duty to the State, but he owes this duty in that form or branch of service for which his civic avocation or occupation best qualify him. Thus, the parson becomes a chaplain, with the rank and pay of a Captain or a Colonel, as the case may be, and if the clergy as a class enjoy practically a certain exemption from duty, it is simply because the troops require fewer chaplains than other officers. The same applies to physicians, who, within the limits of military age, are each and all liable to act as Army Surgeons, in such numbers as the service may require. Teachers have hitherto had some special exemptions, at least in so far as certain practice drills (*Repetitions-Curse*) might interfere with their regular scholastic duties. It is now proposed that after four years from the date at which the present Military Reform Bill shall have become law, no one shall be eligible to any situation as a teacher in a public school who does not possess, and can give satisfactory proof of having gone through, the military instruction required for the qualification of a Subaltern Officer of infantry.

The law provides for the formation of corps not strictly military in the technical sense, such as telegraphists, railway and other machinists, and mere labourers. Thus, if a man is, we will suppose, below the standard stature for any special arm, but otherwise sound and serviceable, he is, according to his trade or occupation, made useful as a farrier, or armourer, or hospital nurse, or *frater* (a sort of ambulance attendant, who is generally an apothecary or apothecary's assistant), in which respective duties he will rank as a Non-commissioned Officer; or he may serve as a mere mechanic, or even labourer, or, again, he may be employed as a clerk in some of the Staff bureaux.

Similarly, each man is allowed, subject of course to rules and regulations, to select the arm of the service which he prefers from taste; or, if necessary, the military authorities of his canton may assign him to that arm for which he is obviously best fitted. Thus, the man who,

either for pleasure or profit, rides or drives his own horse or horses, selects by preference the cavalry or field artillery service. These two arms thus become manned and officered, besides the young men of leisure and means, by the millers, tanners, brewers, corn dealers, &c. In like manner the engineer corps and its several branches, Officers and men, are composed of railway engineers, surveyors, contractors, builders, machinists, and cognate professions.

I am here illustrating a principle. How difficult the application of this principle would be in this country must already have suggested itself to my hearers, and in due time we shall have to describe how its application even in Switzerland affects the efficiency of special branches of the service.

A liability to military duty so sweeping as to be theoretically without exception, save absolute bodily infirmity, would probably be intolerable in any other country, and would in truth be in most other countries the most expensive of all conceivable forms of military organization. It is not so in Switzerland. There it is a thing of immemorial origin. It chimes in with the history, the traditions, the popular instincts, the "folk-lore," as the English language so expressively calls it, of the land. The social life has long since and unconsciously shaped itself according to the necessities of the system. The merchant or manufacturer knows that his book-keeper, or cashier, or other *employé*—the mechanic that his journeyman or his apprentice—has so many days or weeks of drill, or practice, or field exercise to perform. Employer and employed are probably subject to the same liability, and manage to take it by turns, but in any case the current civic business of the country goes on without interruption. I will not say that in many instances, such as the necessity of suddenly placing large bodies of troops on the frontier, and their prolonged maintenance there, which occurred during the late war, does not cause much individual hardship and loss. But these exceptional cases are nothing compared to the heartburn, the breaking up of family ties, the dread of military duty, which conscription in its mildest form involves. The Swiss are essentially a hard-headed, hard-working, frugal, but by no means a stolid race. They love above all things a holiday when a legitimate pretence for it presents itself, and this is afforded by the recruit's drill, the repetition practice, and the occasional field manoeuvres which constitute each man's military duty. He takes that duty seriously, because he is proud of it, but pleasantly also, because it is an occasion for social gatherings; for friendly hob-nobblings; for confirming old acquaintances, and making new ones; for bringing men of different cantons, often astonishingly different in manners and modes of thought, into companionship. And all this with an amount of zealous bustle and conscious self-importance which supplies the keen stimulus of excitement.

It should be added that, however severe in theory are the laws on military obligation, their application varies very much in the different cantons, is in none of them extremely stringent, and certainly never oppressive or vexatious. The contingents supplied by the several cantons to the different divisions of the federal armament, fall far short

of the actual number of able-bodied and thereby legally liable men within the military age. There is thus ample room for *de facto* exemptions beyond the few cases for which the federal law provides. These are: 1st, the Members of the Federal Diet or Parliament, 2nd, the persons actually filling three specially enumerated posts in the Government and higher spheres of administration; 3rd, certain enumerated grades of *employés* in the federal post and telegraph offices, the powder magazines, &c.; and, 4th, the frontier police, which may be considered as a sort of permanent military corps. In addition, the superintendents of prisons, lunatic asylums, &c., have a certain immunity of service. The theory of the law in all these cases is not that of exemption, but rather of temporary prevention or ex-officio immunity, something in the nature of the privileges accorded to Members of Parliament in this country during the session. Should this exceptional immunity cease by the vacation of the office conferring it within the period of age during which each is liable, the person having availed himself of it, is supposed to be obliged to make up for lost time in the drill and instruction of the class to which he belongs. Practically, however, this scanty list of exemptions is largely supplemented by the legislation of the several cantons in favour of the members of their respective Governments and Legislatures. Moreover the duty of military service does not bear on *bonâ fide* absentees. A Swiss, at any period of his military liability, is perfectly at liberty to expatriate himself without asking leave of any one. If a casual absence happens to coincide with a period of service, he is of course regarded as a soldier on duty, and must ask for furlough in regular form, which is readily granted on reasonable cause being shown. The penalties for military misdemeanour in time of peace are little more than nominal, but while on duty, each man is placed under military law—withdrawn from the jurisdiction of the civil courts—and, whatever the nature of his offence may be, it is tried by Courts-martial. All those, who from any cause whatever, ex-officio exemption, absenteeism, or physical disqualification, do not perform, either in whole or in part, the military duty incumbent on others, are subject to a very moderate capitation tax in compensation. It will be seen, therefore, that the Swiss system, although theoretically the precise contrary, has yet in practice a large element of voluntarism. In the projects of reform which are now under consideration, and to which I shall hereafter have occasion to refer, this element—never openly recognized—is sought to be done away with altogether, and a more strictly obligatory system to be rigidly enforced. I greatly doubt whether this policy, though logically correct, will, in the end, be found judicious.

One of the most zealous and able of the Swiss army reformers, Mr. Stämpfli, a member from Berne of the Representative Chamber of the Federal Legislature, reported, on behalf of a special committee in 1866, that whereas the preceding census (December, 1860) showed the number of males in Switzerland to be 1,171,486, of whom 423,856 came within the prescribed age, the number of men actually performing that duty in all the three classes, *élite*, reserve, and landwehr, was only 186,389, or less than one-half. In other words, about 50 per

cent. of the available material was, for some reason or other, not used at all.

Mr. Stämpfli further illustrates this striking contradiction between the theory of the law and its application in practice, by comparing the number of young men who, during a period of ten years, became annually liable to service with those who actually performed it. It appears that the annual average of young men becoming liable during the period between 1852-1862 was 22,900, against 11,719 who appear on the lists as active recruits. So that while in theory, and by a fundamental article of the Constitution, every able-bodied Swiss is a more or less efficient soldier, only about one-half, or rather less, undergo any sort of military training during any period of the 25 years, that is from 20 to 44, for which they are legally liable to duty.

I may here remark that for the few statistics I intend to obtrude, I am largely indebted to Mr. Stämpfli, and, making allowance for a very moderate increase of population, the figures, which he collected with the most scrupulous accuracy in 1866, are still the most available for all practical purposes of argument. I cannot, however, follow Mr. Stämpfli to the extent of the severely logical conclusions he deduces from his figures. I believe, on the contrary, that it is with the military system of Switzerland, as with many other time-honoured institutions that have grown with a nation's growth, one of their chief merits lies in the deviation of the practice from the theory; and I believe that this is quite consistent with both theory and practice being excellent and admirably suited each to its purpose. The Swiss system is assuredly not perfect, but it, has this great and incalculably important merit, that it is pre-eminently *popular* in every sense of the word. I much fear that any reform the better to conform the practice to the theory will cause to appear onerous and oppressive that which with the present latitude is regarded rather as a privilege than a duty.

The contradiction to which I allude would be utterly inexplicable, if we did not remember that with a population of little more than two and a-half millions (or less than that of London), scattered over a territory about half as large as England without Wales, we have to deal with no less than 25 different governments, each sovereign and independent. Nominally the members of the Swiss Confederation are 22, but three of these states, and singularly enough these three among the very smallest ones, have found a single government for each too little for them. Thus one-half of the people of Basle, of Appenzell, and of Unterwalden respectively, have agreed to disagree with the other half, and each of these cantons, though nominally a unit in the Federal Assembly, has in reality two distinct and complete sets of executive, administrative, and legislative machinery.

Formerly each of these governments raised, drilled, uniformed, and armed its troops as it suited its fancy. Provided each supplied its quota to the Confederation in time of need, the latter had no more right to interfere in military matters than in those of coinage, duties, and postal arrangements, all of which exhibited a most beautiful variety of local eccentricities. To this day the militia of each canton is under its own exclusive control. It drills them, officers them, equips them,

arms them, at its own expense, in the proportion of the contingent which the Federal Assembly fixes after each decennial census, and these State or Cantonal troops only become Federal soldiers by being specially sworn into the service of the Confederation, and assuming that armlet of the cross which, with the inversion of the colours, has latterly served as the emblem of neutral charity on the battle field.

But the new Federal Constitution, following on the civil war of '47, the *Sonderbunds Krieg*, made a great step towards centralization in this as in other equally important respects. Uniformity of equipment and armament was established by precise legislation, a minimum of instruction and efficiency fixed, and a certain general superintendence and control reserved to the Federal military authorities. Each Cantonal government was to place on foot and maintain in time of peace an effective force equivalent to three per cent. of its population (foreign residents, which in many cantons are very numerous, being, of course, excepted), and a reserve amounting to one-half of the same; together $4\frac{1}{2}$ per cent. of the native population. In time of war the Confederation disposes of the entire force available. Nothing, of course, prevents each Cantonal government from drilling a much larger force than its Federal quota, and in point of fact most of them do.

Many of those who speak of and treat the Swiss military institutions as a complete, compact, and self-consistent system, will perhaps be surprised to learn that a very considerable difference obtains among the several Cantons as regards the proportionate number of men in each performing military duty. The percentage on the male population ranges as widely as from 22 to 12 per centum between one canton and another. Thus the primeval Canton Schwyz, which claims the honour of having given its name to the Helvetic Confederation, leads, as might be expected, the way with 22 per cent. of its male population doing duty. Another of the forest cantons, Uri, and next the Grisons, follow with 21; the sickly canton of Wallis, composed chiefly of the narrow, deep, and marshy valley of the Upper Rhone, which has the sad speciality of goiters and cretinism, comes last with only 12. The two great and populous cantons of Berne and Zurich form, as nearly as possible, the average between these two extremes with 16 per cent. of their male population.

The leading feature of the Army Reform Bill to which I have already had occasion to refer, is to give to the federal authorities a more direct control over the cantonal forces. For this purpose it is proposed to divide the territory of the Confederation into districts not quite irrespectively of cantonal frontiers, but still to a certain extent independently of them, and to place the military administration of these districts, in so far at least as regards the instruction of officers and men, immediately under the inspection of federal Officers. To the extent that this can be effected, it will undoubtedly be a real improvement upon the prevailing system. But Swiss army reformers are not so bold in their measures as those in this country, and any change so radical as Mr. Cardwell's recent abolition of purchase would not even be dreamed of. The idea of Cantonal independence is so strongly rooted, and local self-government is carried to such extremes, that even

under the new law the cantonal military authorities will retain the exclusive appointment of all regimental officers—each of these twenty-five governments will continue to have its Secretary of State for War *in petto*, with a cantonal staff and a cantonal military budget to match. The tendency, undoubtedly, is to strengthen the federal authority at the expense of the cantonal, but many years must elapse, perhaps some terrible strain may have to be experienced, before a thoroughly centralised organisation can grow out of the present tentative efforts at reform.

I have thought it necessary to dwell at some length upon this curious complication of the Swiss military system, viz.: the division of authority between the Cantons and the Confederation—the latter making the law, the former administering it—because every practical question connected with the subject before us seems to me to hinge upon this point, and yet it is almost always overlooked by those who look only to the federal statute book for the Swiss military system.

Thus the federal law fixes the military age as beginning for each Swiss with the beginning of that year in which he shall become 20, and ending with the end of that year in which he has become 44. During these periods he belongs theoretically to each of three classes in succession, viz., the *élite*, the reserve, and the *landwehr*. The duration of his service in either or in any of these classes is practically left to State legislation, provided only that he does not enter the first class younger than the twentieth year, nor the second or reserve class, later than the thirty-fourth year of age. As for the *landwehr*, there were until recently no regulations at all; it simply consisted of all the men who had completed their active service in the two other classes. Now, provided the canton kept its quota, viz., 3 per cent. of its population in the first, and $1\frac{1}{2}$ per cent. in the second class, complete and efficient, it was obviously free to fix the duration of service. One Canton might see fit to keep its men the entire 14 years in the first class, another only 4, 6, 8, or 12. Again, it might pass its men already in the twenty-sixth year into the reserve, and in the thirtieth into the *landwehr*, without the Confederation having any right to object, provided always the contingents of the two first classes were maintained at their full complement. In point of fact, the different Cantons have largely availed themselves of this latitude, and some have found it more economical to keep the duration of the service up to a maximum, in order to diminish proportionately the number of recruits whom they would annually have to clothe and drill. Thus it will be seen that in some special cases of application the Swiss system of universal liability could be made to somewhat resemble the practice of standing armies.

It is now proposed to do away with the Cantonal quotas determined by a percentage on the population, and while still reserving to the Cantonal governments very considerable latitude in the apportionment of their troops among the three classes, yet to oblige them to equip and drill the whole of their available material. At the same time the *landwehr* or second reserve class, is to receive an organization analogous to that of the two others. Certain exceptions are, however, made

for special branches, as for instance the cavalry, which is to serve seven years in the *élite*, or first class, one year in the reserve; after which liability to service ceases, save in the event of a great national catastrophe. Similarly, the railway and telegraph corps are to serve twelve years in the *élite*, and are then permanently relieved from duty. Field artillery is only organized in the two first classes; but the men on entering the second reserve or *landwehr*, are told off to siege parks and trains.

The Swiss Federal army will thus hereafter be constituted as follows:—

I. Engineer corps, consisting of 9 companies of sappers and miners, 3 companies of pontoniers, and 3 of telegraphists for each of the three classes, viz., 29, 9, and 7 companies of each kind respectively.

II. The artillery consists of—

- 12 8-pounder batteries,
- 36 4-pounder batteries,
- 4 mountain howitzer batteries,
- 20 companies of siege and park artillery,
- 10 companies of park train.

All these equally distributed between the *élite* and the first reserve. The *landwehr*, on the other hand, has only 16 companies of heavy artillery, and 11 of park train.

III. Cavalry, which, as already stated above, only serves in the first class or *élite*, consists of—

- 22 squadrons of dragoons,
- 12 companies of guides.

IV. The sharpshooters consist of 10 battalions for each class, or 30 in all three.

V. The infantry has—

- 57 whole battalions,
- 8 half battalions,
- 7 single companies,

for each of the three classes, or a total of 171 whole battalions, 24 half battalions, and 21 single companies.

The respective strength of each of these “tactical units” is as follows:—

In the engineer corps the company of sappers and miners consists of 120 rank and file, the pontoniers of 100, and in the telegraph corps of 88. Each has 8 saddle-horses and 32 draft horses, to which, in case of need, others may be added by local requisition.

In the artillery a full battery of 8- or 4-pounders, consists of 165 rank and file, with 104 horses. A mountain howitzer battery has 128 rank and file, and 55 horses or mules. A company of heavy artillery or “artillery in position,” has 120 rank and file, with 2 horses. A company of the train has 120 rank and file, with 191 horses. In each of these cases the number of horses may be increased or supplemented by requisition, if necessary.

In the cavalry the full squadron of dragoons consists of 101 rank

and file, and 105 horses; the company of guides of 32 rank and file, and 34 horses.

The battalion of sharpshooters, 4 companies, commanded by a Major, is composed of 490 rank and file, of whom 436 are riflemen. The battalion staff consists of 4 commissioned Officers and 6 non-commissioned Officers. Each company has 1 captain, 2 lieutenants, 1 sergeant-major, 13 other non-commissioned Officers, 1 bugler, 2 pioneers, and 99 riflemen: 8 horses are allowed to a full battalion.

The battalion of infantry, in six companies of 120, consists of 738 rank and file, of whom 654 bear rifles; 14 horses are allowed to each battalion. The battalion staff is composed of 8 commissioned Officers, the highest of the grade of Major, and 10 non-commissioned Officers. The company organization is substantially the same as for the sharpshooters.

A half-battalion, but which constitutes a "tactical unit," has 3 companies, together 373 rank and file, with 6 horses.

We are here naturally led to inquire as to the armament of this force, and upon this point the account to be given must, in the main, be considered as satisfactory. The Swiss have always aimed at and prided themselves upon giving to their militia a superior weapon. This tendency has, to my thinking, led them, in one instance at least, to take a precipitate step which, in the present state of inventive science, is a questionable progress. I mean the adoption of a repeating rifle. Numerous and conclusive experiments, both in Switzerland and elsewhere, have proved that no repeating or magazine rifle yet known can come up to the best class of single breechloader, even in rapidity, if the firing is extended over two or three minutes, so that the man must refill his magazine. The repeater, on the other hand, is far more fatiguing in the manipulation, and, of course, more liable to get out of order on service. The adoption of the Vitterli repeater is, however, still only a theoretical fact, as none have as yet been issued to the troops.

The actual armament of the Swiss troops of the two first categories consists, besides 15,000 Peabody's, purchased in America, and 40,000 "Prelat-Burnand" large-bores, converted according to the Milbank-Amsler system, of the requisite number of new small-bores, with the same, viz., the Milbank-Amsler breechloading arrangement. This bore is as nearly as possible $\frac{1}{4}$ of an inch, therefore about $\frac{1}{2}$ of a hundredth of an inch less than the English Martini-Henry. The cartridge is a rim-fire one, of an American pattern, and has $3\frac{3}{4}$ grammes, or rather less than 60 grains of powder, with a bullet weighing 22 grammes, or about 330 grains. The powder charge is, however, rather larger than nominally indicated, on account of the excessive quantity of fulminate which the peripheric ignition requires. Proportionately the ballistical conditions of the Swiss small-bore are not so different from the Martini-Henry as would at first sight appear. The ratio of charge of powder to weight of bullet is as 4 to 22 in the one, and as 85 to 485 in the other. If, therefore, the weight of the Henry bullet was decreased by only 17 grains, that is to 468 instead of 485, the proportions would be identical. The Swiss

small-bore has rather a flatter trajectory at short ranges, but this, of course, rapidly alters to the contrary at increased distances.

The Swiss were, I believe, the first to introduce the general use of the small-bore in military rifles, and at all events their troops of the two first categories of service have for upwards of two years been thoroughly trained and accustomed to the use of breechloaders.

A general compliment may likewise, I believe, be paid to the Swiss field artillery, and especially to the light mountain howitzers, which are admirably adapted to the topographical conditions of the country. They are 3-pounders, with carriages so disposed that in case of need the several parts can be carried on men's backs.

Annual drill excursions are made with these among the higher Alpine passes, and the ease and readiness with which these pieces are transported, even where the mule is no longer available, would astonish those who are not familiar with the high Alps and their sturdy inhabitants. The 4-pounder batteries are of cast-steel, on Broadwell's breechloading principle, the 8-pounders of bronze, on the Prussian wedge block system (*Keil-verschluss*). The Swiss were the first to use iron gun-carriages. Rocket batteries, and also field artillery of heavier calibre than here mentioned, have latterly been done away with. As a rule the men assigned to the artillery take to their work kindly, and learn it with surprising alacrity. The great difficulty in this branch of the service, and still more in the cavalry, lies with the horses. If the training of the men can only be eked out by a superior intelligence or special aptitude on their part, it is obviously quite the reverse with animals whose owners, in their every-day avocations use them for utterly different purposes. It is next to impossible in the short period of annual drill to get the horses used to work together. The train companies are generally manned by coachmen, carters, ostlers, and their class, but even they are not accustomed to the kind of driving required, especially with strange horses. This is one of the grave defects which might become painfully evident in actual campaigning, and even in the mere peace-drill, the accidents and damage arising from this cause are disproportionately numerous. Only a very limited number of horses, and those only for the use of the superior Officers of the Staff, are permanently kept on hand by the Federal Government. The mass has to be provided by the Cantons. The selection, appraisalment, before and after service, the indemnities to be paid for damage incurred, &c., naturally lead to a good deal of jobbery, which is not calculated to raise the efficiency of the mounted services. It is endeavoured to do away with this defect in some degree by making, as we have seen, the duty of the mounted soldier more continuous in the earlier stages of his liability, and then either wholly or in part exempting him from the reserve and *landwehr*.

Some difficulties are also placed by recent enactments to the owner's disposing of a horse which has once been accepted, and substituting a new one. The value of the horses, according to the service for which they are taken, varies largely—from 400 to 1,200 francs, say £15 to £50, for horses are by no means cheap in Switzerland.

Besides a generally low standard in this respect, it must be added

that the state of the gear and accoutrements leave much to be desired, and seldom come up to the smartness of the regular service in other countries. The men have scarcely an opportunity of "getting up" the very important points connected with stable duty, which, from the nature of the case in peace drills, falls mainly upon the non-commissioned instructors appointed by the Federal authorities.

The time apportioned to the drill, both of instruction and of repetition, will strike most of my hearers as surprisingly short, and quite insufficient. It is for the recruits of the engineer and artillery corps respectively 48 days; for the cavalry—dragoons 55 days, and the guides 41 days; for the sharpshooters 34 days. As repetition drill the engineers and artillery are generally called out for 14 days, and the cavalry every year for 7 days.

In the infantry the recruit is drilled during the first year for 34 days, and each year following for 6 days. The cadres, that is to say, the Officers and non-commissioned Officers, are called in one or two days earlier than the file. The drill from the first is, so far as circumstances will admit, by tactical units, and for this purpose the Federal military districts correspond to divisions of the Federal Army, the Cantonal military districts to brigades, battalions, or, in special cases, half battalions. In all drilling subsequent to the instruction of the mere recruit, the different arms are to act conjointly, and where any of the smaller Cantons lack any special arm, such as cavalry or artillery, they are to unite with neighbouring cantons for the practice of their men, and any additional expense arising therefrom is borne by the Confederation.

Men who, from any cause have not performed their duty in the first category of age, are liable to recruit's drill upon entering on the next following category.

The drill in all its stages is hereafter to be directed by Federal instructors of various grades, corresponding to the importance of the troops collected together.

The prescribed maximum of annual drill is exclusive of such field manoeuvres on a larger scale as the Federal Government may from time to time order, and, in point of fact, executes generally every two years. Care is of course taken that the service for this purpose does not in the long run fall more heavily upon some one or more Cantons than upon others.

The theory of the law assumes a sort of general expropriation for military necessities, of course against suitable indemnification, and, therefore, everything needed for the troops may, under certain circumstances, and in a duly prescribed form, be requisitioned.

Slight and apparently insufficient as the training is as compared to standing armies, it must be kept in mind that the Swiss unquestionably possess a special aptitude for military service. In many of the mountain Cantons every man is more or less by profession a hunter, and, therefore, a marksman. Nearly every village has its shooting range, and cantonal and federal "*Schützen Vereine*," or "Riflemen's Associations," constantly bring together vast gatherings of practised shots to a great holiday and jubilation. Moreover, the policy of assigning each

man to the branch of service for which he is best fitted by his civic occupation—the boatman to the pontoniers, the machinist to the engineer corps—greatly facilitates the task of the instructor.

It is in this, and in the peculiar character of the Swiss, and the circumstances of their social life—as I intimated at the outset—that the so-called Swiss system really consists, rather than in the clauses of the Federal legislation, and its application by the cantonal authorities.

The Swiss has, as a rule, an excellent primary school education to begin with. From an early age, in some cantons as early as 19, he is called on to take an active interest and part in public questions. Some of the smaller forest cantons, as is well known, still preserve the primitive form of a pure democracy, so that the legislature, or *landsgemeinde*, consists of every male in the Canton. But even some of the large cantons, such as Zurich, provide for their citizens an amount of participation in public business which would be simply impossible anywhere else. The most minute questions of cantonal legislation or administration are constantly and habitually submitted to the popular vote. All offices are elective. Revisions of the Constitution are frequent, and debated with vehement partisanship. Societies for every conceivable public purpose are more numerous than even in England. If this political activity may justly be considered excessive, it has at least this effect, that even the lowest average capacity is associated with the public business, that each readily conforms to an obligation which he may be said to have imposed on himself, and finally that he is thoroughly accustomed to co-operative action. Where all these circumstances do not exist in the same degree, I cannot bring myself to believe that the Swiss military system would give the same results. As it is the Swiss militia, as a whole, present a body of men of highly creditable efficiency and discipline. Where it is most open to criticism is in the general average of its Officers.

I need say little of the Federal Staff, which in its composition and organization is not essentially different from that of any regular army, and numbers many men of distinguished ability. I may only remark, in passing, that promotion beyond the rank of Captain is by selection in contradistinction to seniority. The superior Officers of the several departments, the Federal Legislature, and also the Cantonal Governments, may present nominees, but the appointment lies in time of peace with the Executive Council of the Confederation, and in time of war with the Commander-in-Chief. The latter is always elected *ad hoc*, and for the duration of a campaign, with but little, if any restriction as to choice, and during his functions enjoys an almost dictatorial authority. When these terminate, he retains merely an honorary rank.

The appointment of the Cantonal Officers, that is, the whole mass of the Officers of the "tactical units" comprising the federal forces, is one of the most peculiar features of the system. Formerly, and to a great extent even yet, the Cantonal authorities had the widest discretion in this respect. Some degree of uniformity is now sought to be established by the enactments in the new Army Organization Bill. According to these, every commissioned Officer must previously have served as a non-commissioned Officer, and he must be recommended

by the other Officers of the "tactical unit," i.e., battalion, battery, or company to which he belongs. The non-commissioned Officers are appointed by the Commandant of the battalion, after consultation with his Officers and non-commissioned Officers. The grade is only then definitively conferred when the nominee has passed successfully through a prescribed course of instruction at the respective federal school of his arm. It will impress my hearers as highly characteristic and significant that the acceptance of a grade for which he may be qualified is *obligatory* upon every man liable to service. Every Cantonal Government is required to send to the several federal schools of Officers' instruction annually at least as many qualified non-commissioned Officers of each arm as may be needed to fill the grades in its contingent for the next ensuing year. Besides the Federal schools for each arm, there are special Staff schools for instruction, subdivided into General Staff, Sanitary, Commissariat, Veterinary, &c., &c. Annually some few of these Officers are sent abroad at the expense of the Federal Treasury to witness field manoeuvres, visit the military establishments, &c., of other countries, and report thereon. Each Officer, moreover, besides his regular routine of service, is held to perform such special duty as may be assigned to him by the Commander of his brigade or division.

I shall doubtless be expected here to make some mention of the *Cadets*—those tiny warriors from 9 years old to 15, whom most tourists in Switzerland have admired at their mimic drill. They are not, as is often supposed, properly speaking, a part of the Swiss military system, although by the projected reforms they may in time partially become so. As they at present exist, they are simply juvenile volunteer corps connected with the national schools in some of the larger towns, more or less encouraged by some of the cantonal authorities, but chiefly dependent on the free will of the parents and the private contributions of liberal friends of youth. They are not so numerous as I should wish them to be; there are probably not exceeding 7,000 or 8,000 in all Switzerland, that is barely 3 per cent. of the boys within the school-attending age; but precise statistics on this point are wanting. So far as it goes, this school-boy play at soldiering is worthy of the highest commendation, and I know of nothing in the manners and customs of my native land which I would so unhesitatingly recommend for immediate imitation in this. The great public schools, of which England is justly proud, appear to me marvellously well adapted for fructifying an idea which had its origin in the Swiss cantonal schools, and had there to contend against serious and peculiar difficulties, without preventing it from achieving a very fair success. There are, of course, valid objections to be raised against it. Playing with fire-arms is proverbially a dangerous game, and if they are entrusted to youngsters of the playful age within 9 and 15, a vast amount of unsafeness may safely be reckoned upon. My valued collaborator, Mr. Martini, has directed my attention to the fact that a certain reaction has lately gained ground in Switzerland against the cadet system, and that it is justified by facts which cannot in fairness be ignored. To mention only one, by way of illus-

tration. A friend of his who was as warm an advocate of the school-boy "cadet" as I am disposed to be, had his ideas on the subject severely modified latterly by having his eldest son brought home to him shot through the lungs with a ramrod. (Let us hope that breech-loading will diminish gun accidents of this as of other descriptions to a minimum.) It has also been found that the boy tired of his cadet-drill, and on reaching manhood, took unkindly to a serious duty which had palled on his taste as a boyish play. I am bound to say that Mr. Martini's personal observations are in a Canton—the only one I know of—where the cadet instruction was attempted to be made compulsory. I have a strong conviction, for my own part, that many things, excellent in their way, are "run into the ground," in other countries as well as Switzerland, by enthusiastic partisans disregarding the poignant wisdom of Talleyrand's maxim, *surtout pas trop de zèle*.

In my humble opinion the boy has, in this particular case, been wiser than the man, and the Swiss schoolboys have engrafted on the military system of their country a new and original feature, which their fathers are doing their best to spoil.

I am not prepared with any statistics to confirm an *à priori* opinion of mine, that the use of fire-arms by boys, under reasonable precautions, will not necessarily cause more numerous accidents than the ordinary athletic exercises of English universities and public schools, not to make any invidious mention of Rugby football. The majority of these have an unfortunate tendency to degenerate into mere sport, and assimilate to "turf-practice," and at their best they are apt to take up an undue proportion of the time and energy of a youth whose sole business it is to qualify himself for some useful and remunerative civic pursuit. Now there is in the mere mimicry of the soldier's duty something of itself serious, steady, and disciplinarian. Whether considered as a preliminary preparation for military service, or—as I should prefer to consider it on broader grounds—as teaching boys self-respect, as distinguished from the rowdiness which at their age is so often mistaken for manliness—subordination without obsequiousness—smartness in the good sense of the word, or what the French call *tenue*—I can imagine nothing better than this plan of boy volunteers, provided always that they are truly volunteers, and join their company of their own inclination, with consent of their natural guardians, and without compulsion from the State.

The Swiss cadets have a serviceable and inexpensive uniform, which answers capitally for a school dress, and is at its worst more pleasing to the eye than the tall "chimney-pot" on the head of a small-sized lad in a jacket. The armament is in part supplied by the canton, or by private subscription, and I know of one or two neat artillery companies, and of one of pontoniers, who occasionally attempt field manoeuvres with their youthful brethren in arms of adjoining cantons. They officer themselves up to the grade of captain of a company, which is filled by one of their teachers acting as instructor, and a high sense of honour there is instilled in a boy—not devoid of a grave sense of responsibility as well—who at 13, 14, or 15 waves his tiny sword as second or first

lieutenant of a company of his school-mates. Shooting matches for prizes take place from time to time, and it is difficult to say who enjoys the fun the most, whether the little competitors swelling with conscious self-importance, or the admiring papas, mammas, sisters, and the grown-up folk generally.

It is now proposed to do away with the cadet system in its present self-developed form, by abolishing all grades among boy volunteers, and making it obligatory on the Cantonal Governments to provide elementary military instruction or drill in the schools, at least within the ages of 13 and 15. Moreover, the boy, after he leaves school at 15, and until at the age of 20 he becomes a federal recruit, is to have at least 15 half-days' practice drill. With a sincere respect for the logical minds of the leading Swiss Army reformers, with equally sincere admiration for the lucidity with which they propound their views, and giving them credit for the best intentions, I cannot help thinking that they are "riding a willing horse to death." My preference, be it understood, is throughout for the voluntary principle, applied wherever possible, and the largest admixture of it with any scheme of military organization that may be found consistent with efficiency, and with the necessities of each country.

I propose now to sum up in a few words the leading facts which characterise the Swiss system, and for this purpose I cannot do better than avail myself of the admirable statistics collected by Mr. Stämpfli, whom I have already quoted.

It appears, then, that under the present practice about 10,000 recruits, of the age of 20, are annually drilled, clothed, armed, and organized into tactical units. About 40,000 men, between the ages of 21 and 28, belonging to the *élite* or first ban, are annually mustered, and practised in bodies of greater or less strength, occasionally increased to the size of a division of, say 10,000 of all arms. Some 20,000 more, between the ages of 28 and 34, and belonging to the reserve or second ban, receive annually a similar instruction. The last ban or *landwehr* merely muster one day each year, or two days every alternate year.

The entire available federal force of the three classes is, in round numbers, as follows:—

<i>Auszug</i> , or first ban	80,000 men.
<i>Reserve</i> , or second ban	45,000 "
<i>Landwehr</i> , or arrier ban	75,000 "
Total	200,000 "

As the present legislation making the liability to service 25 years, only dates from 1850, the last class, or *landwehr*, will still annually augment until 1875, when the total will have reached approximately 250,000 men.

The special arms comprise about 20 per cent. of the total force in the two first bans, and somewhat less in the last. The cavalry is the weakest, numbering only about 3,000 horse. On the other hand, the artillery is comparatively strong, with 45 mounted batteries, and a corresponding number of guns in position and reserve parks.

The sharpshooters number between 9,000 and 10,000 men. Of sappers and miners, pioneers and pontoniers, about 1,600.

The time occupied by each man during the whole period of his military service may be reckoned approximately as follows:—

For the infantry, from..	..	..	100 to 110 days.
Engineers, artillery, sharpshooters	..	..	160 „
Cavalry ..	..	..	170 „

All non-commissioned Officers on an average about half as many days more, and commissioned Officers double that number of days. This gives an average of about $6\frac{1}{2}$ days annually for all grades and arms.

The actual annual outlay is below £400,000, which is apportioned as follows:—

The Federal military budget, about	..	..	£120,000
The different cantons, about	..	..	200,000
The men themselves, who in some of the cantons are called upon to pay partially for their equipment, about	..	..	30,000
Total, one year in another, about..	..	..	£350,000

which averages about 33s. per man, or 2s. 10d. per head of the population.

In this outlay are comprised, besides, of course, the cost of the higher branches of military administration, the following important items:—

1st. The man's pay, 4½d. per diem, and a ration of meat and bread.

2nd. A complete outfit, equipment, and arming of each recruit.

3rd. Ordinary maintenance and replacement of military stores and material.

4th. Hire of horses, at 2s. 6d. per day.

The clothing is estimated at about £5 per man for the infantry soldier, a trifle more for the sharpshooters and other special corps, and rather more than £10 per man for the cavalry.

The arm and other equipment range from nearly £4 for the infantry man to £14 10s. for the cavalrist. For the rifle of the infantry soldier £3 7s. is estimated, and for that of the sharpshooter as much as £5, which proves that, in this respect at least, the Swiss system does not deal stingily with its militia.

The cost of instruction is estimated at about £2 12s. for the infantry man, £5 15s. for the sharpshooter, £6 16s. for the engineer corps and branches, £13 10s. for the artillery, and rather upwards of £30 for the cavalry per man and horse.

The Swiss militiaman thus represents individually a money outlay under the several heads of clothing, arm, and equipment, and of instruction, from first to last as follows, according to the arm to which he is assigned:—Infantry about £11, sharpshooters and engineers about £17, artillery between £36 and £45, cavalry £54.

Of this amount, in some of the cantons, each man upon entering on

duty a recruit has to bear a part, which ranges from £1 13s. for the infantry soldier to nearly £4 for the cavalrist. This does not, however, represent the actual expense to which the man is put while on drill and practice. The Swiss loves to eat five times a day and to drink in proportion, and these occasions are made the most of for a little extra indulgence beyond the frugal habits of every-day life. The poorest brings some money with him, and if his own pocket does not suffice, his wealthier comrades see to it that he fares none the worse.

Colonel Herzog, who recently commanded the Corps of Observation on the French frontier, to which Bourbaki surrendered, expressed some years ago to Mr. Martini his grave doubts whether the Swiss system was quite so cheap as it appeared from the cantonal and federal budgets. *Per contra*, Mr. Stämpfli proves triumphantly that Belgium, which most closely resembles Switzerland in many respects, spends annually upwards of £2,000,000 in its war budget, while the Swiss system gives an organized effective force of double the number for less than £400,000.

At the risk of becoming wearisome by repetition, I wish once more to direct attention to the cardinal principle of the Swiss organisation. The central or federal authority assumes the supreme direction of military affairs; it fixes by law the organisation and formation, the dress, equipment, arming, and a minimum of drill. It takes upon itself, and at its own expense, the higher military instruction, and also that of special arms. But—and this is a most important “but”—everything else is left to the 25 Cantonal Governments. These clothe, equip, and arm the men in accordance with the federal laws; these supply the war material and all necessary stores, as well as the horses. As regards the infantry, that is to say the vast body of the troops, the Cantonal Governments have hitherto been omnipotent in officering, drilling, and managing it.

Thus far I have illustrated this peculiar function of the cantonal governments rather by the irregularities which it inevitably imports into what is conventionally called the Swiss system. I wish now to express my firm conviction that the chief merit of the system resides precisely in this seeming defect. It is the extreme localization which makes the Swiss militia effective, and I am persuaded that any imitation, even partial, in which this localization is lost sight of, will ignominiously break down in the first experimental attempt.

Each canton has its military administration complete within itself; each its own arsenals, store-houses, parade-grounds, shooting ranges, &c., &c. Each furnishes what it can best give—the forest cantons sharpshooters and mountain howitzer batteries, the large frontier towns like Basle, Geneva, or Zurich, artillery in position, and in each case that which for defensive warfare is first required, is already and normally in the place where it is wanted. Nor is the great disparity in size and population which prevails among the cantons—one having less than 6,000 males, and another nearly a quarter of a million—a serious difficulty. It rather tends to direct undivided attention in each canton to the perfection of that special arm, which the pursuits and habits of its inhabitants best qualify it to supply to the federal forces.

Thus, if you wished to apply the Swiss system with any prospect of success in this country, say, to the Volunteers, or Yeomanry, or Militia, you would have to provide not only distinct but appropriate organizations in every county, and even parts of counties. The seaboard would by preference have to furnish Coast Guard men, or some sort of naval Volunteers; agricultural districts, Heavy Cavalry and Infantry; the great cities, Artillery; the Highlands, Sharpshooters; the "Black Country," a Volunteer Engineer Corps.

Moreover, under the Swiss system, each man of the first and second ban takes his personal equipment and accoutrement home with him. It is only on passing into the landwehr that he surrenders back to the State his rifle and military belongings. Every homestead is thus constituted a sort of miniature *dépôt* of part of the common stock of war material available for the national defence. Of course strict prohibition exists against the man making use of any part of his military outfit otherwise than when on duty.

I think I need say no more to show the extreme difficulty of a wholesale application of the Swiss system in other States. That it contains excellent principles, which are universally applicable, no one can gainsay, but their practical value will depend upon the judiciousness and discrimination with which they are adapted to altered circumstances. I think, for instance, that the Prussians have known how to use some of the best features of the Swiss system, and yet used them for purposes diametrically opposed to the Swiss—for the purposes of a highly centralized, intensely military, and, from the necessities of its position, an aggressive state.

Even in Prussia, as the present audience well knows, the theory of universal liability to military duty, is never practically enforced except in cases of extreme national necessity.

On the other hand, there is a striking instance which I believe is not generally known in this country, of a militia system, in theory identical with the Swiss, utterly breaking down. I refer to the United States of America. Most, if not all, the States of the American Union still retain upon their statute books enactments to compel every able-bodied white male to present himself at stated times and places to be duly mustered, drilled, regimented and brigaded according to the laws made and provided for the organization and instruction of an efficient militia. The only result—and to this there are literally no exceptions—in all the States was that imposing array of citizen Generals, Colonels, and Majors, whose designations supplied the craving for titles or "handles to one's name," and which so puzzled the foreign student of American manners, until a terrible war brought the sham into too sharp a contrast with real military grades. But in America, the militia system however, wherever, and whenever tried, was never more than a farce. It did not suit the habits of the people, either north, south, east, or west, although volunteers for any actual service, either against the Indians or against Mexico, or for fighting of any kind, were always abundant. The militia muster was compulsory, and therefore unpopular; it had no obvious purpose, and therefore appeared ridiculous. *Per contra*, nearly every town in America, and

especially in the Southern and South Western States, had its one or more volunteer companies whom the State formally recognized as part of its organized force, by supplying them with arms, but otherwise left pretty much to themselves in all that regarded their internal government and discipline. They uniformed themselves more or less gaudily and gracefully according to their own taste, and the only consideration the State exacted in return for the arms furnished was, that they should perform a certain amount of drill and of annual camp duty, and be at the orders of the civil authorities if a disturbance of the public peace, a conflagration, or other grave cause required the intervention of an armed force. These volunteer companies were the first and only troops of whom the Confederacy could dispose on the outbreak of the War of Secession. They were the men who garrisoned Norfolk Navy Yard upon its precipitate abandonment by the Federal military authorities, and they were the men who won the victory of Bull Run, which first opened the eyes of Europe to the seriousness of the struggle. They had each and all volunteered to the governors of their respective States for war duty, such of their individual members as were from any cause prevented, resigning or constituting themselves *dépôt* companies at home. They had all exchanged their fancy uniforms for the sober Confederate grey, been sworn into the Confederate service as twelve months' enlisted men, and marched within a few hours' notice to the seat of war, perhaps, as in the case of the Gulf States, a thousand miles away from home. When the war assumed the dimensions we all know, and when after the battle of Bull Run the Confederate Congress decided to raise at once 400 regiments instead of the 50 or 60 it had then under arms, these young men had already seen some six months' pretty hard service, and they for the most part officered the new levies, their places in the ranks being taken by new recruits who thought it a great privilege to fill them.

I dwell upon this American illustration because, while it exhibits the inevitable failure of a militia system which is inappropriate to the habits of a country, it seems to me to disprove the objection so often made against "mere militia" on account of supposed insufficient training. The Confederate troops to whom I have referred were in every sense of the term a "mere militia," but they were a voluntary one, at least in their original formation. I am satisfied from personal observation that a very few weeks will do wonders to make a man who has his heart in the work, a soldier; and I greatly doubt whether the soldier once formed, is afterwards much improved by the routine of barracks and garrison duty. I have seen a few practised men suffice to make a whole company or even a battalion "smart" and efficient in some of the most difficult things that the "regular" has to be taught, such as promptness in pitching or striking tents, rapid shifting of quarters, night marches, and outpost duty. As for making the best of adverse or unexpected circumstances, in other words the art of taking care of himself, I feel sure that his ordinary civilian habits will almost always give the man who is only occasionally a soldier, a marked superiority over the veteran trooper. I mean of course that the occasional soldier should not be part of a mere rabble, but be

animated by that spirit which, rather than drill, makes a man reliable under fire. This is where, in my opinion, the Prussians had so much the advantage over the French.

In further confirmation of my view that it is not so much prolonged training that makes troops effective, I may point to the fact that the most momentous struggles in history have generally been fought out with more or less raw troops. It is in the nature of things that the ready food for powder is first used up, and must be replaced whether by conscription or enlistment, with recruits to whom there is no time to give the martinet polish of peaceful times. I believe I am right in saying that during the Peninsular Campaign many regiments joined the future "Iron Duke" which had barely had a few weeks' drill before embarkation.

What then, I mean to say, with all due deference to more experienced opinions than mine, is, that the Swiss military system is neither good *because* it is a militia system, nor, on the other hand, is it bad because of that reason. It is singularly well adapted to Swiss circumstances and habits; it is not adapted in its present form to English circumstances and habits; but it contains principles and features which may be studied with profit and applied here. Among these I may mention the encouragement of boy volunteers in the public schools, and a greater development and elaboration of the local organization of the grown-up volunteers.

I see in the interest which has of late been bestowed upon the Swiss military institutions, the indication of a very decided progress in civilization. It is the tendency of relying more upon the "reserve forces" than upon a huge "standing Army," and this implies short terms of service, suitable provision for the discharged soldier; in other words, his return to civil life, instead of forming a class or caste apart. It is the tendency also to do away with conscription, which, to me, is the most objectional of all forms of military service, and which, instead of making that service a training school, as it ought to be, makes it a cause of national demoralization. Let us hope, also, that this tendency to a more popular form of military organization implies preparation for defence rather than attack, and thus point to the diminution of the causes of war.

But until the millenium of the Peace Society shall actually have dawned, I do not expect, nor would I wish to see standing armies altogether abolished. Great States, whether their colonies are in the four quarters of the globe, as those of Great Britain, or whether their expansion is confined to an internal self-development, as in the United States of America, require a force, however small, of professional soldiers. I go further and say, that independently of the peculiar circumstances of either Great Britain or America, no State which has great centres of population can safely dispense with such a force. It need not be so large as to endanger public liberty, but it must be thoroughly efficient for maintaining public order, and it ought to afford a standard and a model to that Militia to which the State may then safely entrust the duty of national self-defence.

The CHAIRMAN: If any gentleman wishes to address the meeting, he will now have the opportunity of doing so. Mr. Hotze, in addition to the service he has done by reading this excellent paper, is ready to give any further information, or to answer any question that may be put to him. At the same time I may mention that by the rules which have been laid down for our guidance, ten minutes only are allowed to each speaker, and to this rule it is necessary, for very sufficient reasons, that we should rigidly adhere.

Mr. KNOX: After the excellent paper which has just been read by Mr. Hotze, to whom not only are we in this room, but all those who are likely to read his lecture will be, very much indebted, in order that a debate may be commenced, I hope you will allow me to make a few remarks. To Mr. Martini, Mr. Hotze's collaborator, the people of England are likely very soon to owe another debt of obligation for his share in the invention of the Martini-Henry rifle. The principle service that has been done by the lecturer is that he has exploded, I feel certain, in the minds of all present, and will explode in the minds of others, the idea that the system of the Swiss Army can be applied to this country for the formation of the Army of England. He has proved as clearly as possible that the Swiss organization is not very much more than our own Volunteer organization; that it hardly approaches in completeness our Militia organization, and that it very far falls short of the organization of our regular Army. The fact that in the first instance the infantry soldier in Switzerland is drilled for only 34 days, and that subsequently he is drilled only for some six days in the year for a short number of years, and that after that he is hardly drilled at all, shows that he receives very little more drill than our English Volunteers. It is true that the recruits of the Volunteers at the present time do not undergo the same amount of drill that those who joined the Volunteers in the first instance did, but these latter still form a large portion of our Volunteers, and I know, for I was one of them myself, they drilled from 30 to 40, 60, 90 days in the first year of their service; and they subsequently kept up their drill for a very much larger number of days than it appears the infantry in Switzerland are called upon to do. There is no doubt that in many things our Volunteer system has been allowed to adopt a *laissez-faire* principle even more than appears to have grown up in Switzerland with regard to the Swiss Army, or the Swiss Militia, as it may be more properly termed. In that respect the volunteer system of this country might be very much improved. I believe it is the fault of the Volunteers themselves, or, perhaps, more correctly speaking, of a few of their leaders, that the Volunteers are not in a much better position than they are at present, and fully equal in every way to the Swiss Militia. As regards our own Militia, every one here knows that the Militia soldier undergoes during the first year's training, and has undergone for many years past, six weeks' continuous drill; and that for the remainder of his service he is drilled continuously for a month every year. That service for quite 50 per cent. of the Militia, extends to something like nine or ten years. This fact alone shows that our Militia is a far better trained force than the Swiss Militia, as it has been described in the admirable paper which has been read to us this evening. As regards its practice, however, that is to say its mimic fights, and so on, we certainly fall considerably short when compared with the Swiss Militia. There is no doubt that, as the attention of the country has now been turned to this very important point, some endeavours will be made, in fact they have already been announced, to practise our own Militia in exercises of this kind. The first year's drill of two months it has been proposed should be extended to six months, by the Government Army Bill; and that the Militia recruit in the first year of his joining, should be drilled in the winter, when it is supposed it will not so much interfere with his employment. In fact, to a very large number of men in the agricultural counties, it will be a considerable advantage that they should be drilled continuously for the maximum period of six months in the winter; and that subsequently, they should have their month's drill every year. Supposing six months were given as the period of drill in the first year, this subsequent month's drill might be considerably shortened, and if such practices as those which have been described as taking place in the Swiss Army, were substituted for a portion of the annual drill of the Militia, there is no doubt that our own Militia would be very much improved. As regards the proposal that our Army should be

organized upon the principles of the Swiss Army, which has really been soberly made in a very large number of newspapers in this country, and in innumerable pamphlets, I think the description that has been given to us this evening has quite exploded the notion. Our own Army, as Mr. Hotze stated, is one of those armies which are desirable as a regular Army, and is needed by us in consequence of the position this country holds in the civilized world. Our regular Army is not Militia, nor is it simply intended for defensive purposes. It has to maintain our position, and, in consequence of the deeds of the past, and in consequence of all the good this nation has done all over the world, we lay claim to a high position in the world. And we consider it is impossible for us to maintain that position without at the same time having an Army available for service all over the world, to support our views, our disinterested views, in the policy we may adopt in the advancement of civilization. It has been shown, I think, that our regular Army, to be able to engage with the large regular armies of continental countries, must be a numerous one. I quite agree with Mr. Hotze, that the only sound principle upon which a regular Army can be raised is by the volunteer principle. I believe no other principle will ever go down with the people of this country. But a volunteer Army means a costly and an expensive Army; but I believe the people of this country are willing to pay the price for such a volunteer Army. Now, there is only one means of obtaining that large Army at anything like a fair cost, that is, by adopting the principle which Mr. Hotze has insisted upon, that of short service. That, as he has already suggested, may be tried in this country upon a principle which is different from that on which any experiment for raising an Army has been tried in any other country. That is what we are now doing; we are endeavouring in this country, for the first time, to establish our regular Army upon a system of short service; and, notwithstanding that, to raise our troops by means of voluntary service. That is a perfectly new idea; it has never been tried, one may say, anywhere else in a time of peace. Of course, volunteers have been asked for in time of war for only short periods of service. But in time of peace to raise our Army by asking a man to serve in it for only a short time, and then to enter the Reserve forces, is a perfectly new experiment. It is an experiment which I believe the country would do well to make; it will give them an Army of fully trained soldiers; it will give them a cheap Army, as compared with the number of men available, and I believe it will give them an Army capable of sustaining their cause wherever its services may be required, better than any Army we have ever had, as I believe you will obtain a better class of men in the Army by a system of that kind. This system also gets rid of one difficulty which has been alluded to by Mr. Hotze, viz., that when an Army has been placed in the field, and it immediately begins to supply its losses by drawing upon the population of the country, it has, invariably, up to the present time, certainly in this country, drawn upon the youngest and least trained of its population. Supposing the experiment which is now being made turns out successful, the result will be that, instead of drafting into our Army when on active service abroad, ill-trained and younger men, we shall draft into it men who have been excellently well trained, and every man added will be older than the man who has already served in the war. That is a complete answer to those who have been talking so much about our youthful Army, our Army of boys. The Army, as it exists with small battalions during time of peace, is a young Army; but, these young men having passed through that Army, thoroughly trained and disciplined into civil life, will be available as older soldiers in case of emergency. So that to say our Army is an Army of boys is to take up a thoroughly assailable position; because the Army, when placed on the footing of active service, immediately becomes an older Army in every sense, by every man who is added to it for service.

MR. EDWIN CHADWICK, C.B.: As the gentleman is from the War Office who has just started the ball, I must meet him at once by saying, that what the lecture finally disposes of is the opinion, orthodox in that office as an organic principle, that three years or two years of continuous service is necessary to make a soldier. I take it that that is disposed of entirely by the fact that two years or one year of continuous service, and even shorter periods, consistent with the men remaining at home and carrying on, with but little material interruption, their civil occupations enables better soldiers

to be made, than the system of our War Office, which this gentleman calls a cheap system, attains. I daresay it is rather surprising to many people here, and to some degree to myself, to hear what very short periods are deemed to suffice to make men efficient soldiers, and to get out a well-organized manœuvring field force in Switzerland. I would ask Mr. Hotze, who has had some experience in America amongst people related to us, what amount of actual drill or training, under his observation, did suffice to make them competent to go into the field?

Mr. HOTZE: My only experience in that case was under circumstances where one might say there was a most extraordinary public excitement. That is to say, there was a great national war in which every man, every woman, and every child took part, and when the mind was in a state of white heat; therefore, the promptness with which civilians became soldiers on that occasion would not be an absolutely fair test of what they might be made in ordinary times when they have not the same inducements. But I believe, and I think I have indicated it as far as the limits of my subject allowed me, that, according to my personal observation, which after all is only a limited one, I do not believe it is necessary to keep a man a very long time under drill. I mean if he has his heart in the cause. I think when a man takes naturally to becoming a soldier, that he can be made one in surprisingly quick time; and that the ploughboy who does not want to be a soldier can never be made a soldier; or it takes years and years to hammer him into one. I think my friend will take that as sufficiently applied, because the absolute limit could not be given. I would not say it would take six days, or six weeks, or six months: it would depend very much upon the character of the man, and I think also very much upon periods of excitement. When a nation comes to war we see sometimes these surprising epidemics of excitement; we see a population, which yesterday was perfectly pacific, suddenly become enraged and furious. Under those circumstances the women will urge them on, and spurn them as cowards if they do not go. And the men themselves will, naturally, take to it. They will have seen men drill and march, and, between times, instruct each other by way of just getting the ordinary manœuvre or handling of troops.

Mr. CHADWICK: I further beg to observe in answer to what the gentleman from the War Office has stated with respect to the analogy of the Swiss force with our Volunteer force, that it is not warranted, because the organization of the Swiss is that of a practised manœuvring field force, of a complete Army, and such an Army! I refer him for that opinion to a pamphlet that has been published by that distinguished Officer, Major-General Sir Lintorn Simmonds, who has examined it. I quote his words:—"More than once during the present war have the 'Swiss' Government found it necessary to send a force to watch the French frontier, and on one occasion, it is said that a force of 60,000 men of all arms was placed on the frontier, complete in every respect, within a week or ten days from the time of their being summoned from their civil occupations. This fact will illustrate the value of the system, and evinces a degree of organization and administrative ability which might well put Great Britain to the blush. Is there any man in this country who believes that our War Administration would enable us at so short a notice in the midst of peace to assemble a like force in a condition to take the field, complete with artillery, ammunition, and transport trains, hospital arrangements, and commissariat in double that time? And still we maintain a large force at an enormous expenditure, and claim to be a first-rate power." These, I beg to observe, are the words of the experienced Commandant of our first military academy. It was declared that within a fortnight, if there had been need of it, Switzerland would have placed a completely organized Army of 200,000 men on the frontiers! I must, however, object to the term which General Simmonds applies to it, as being after all "only a Militia," and that, being "only" a Militia, it could not be expected to maintain its own in the open field against highly-trained and regular troops. I may cite another opinion on that, even against the Commandant of the Woolwich Academy. But I submit that the term Militia is improperly applied to denote an organized Army, which here is a loose force differing from county to county from the present rubbish in some, to a tolerably solid respectable force, if organized, in others. I have it from a German authority, that ten years ago when Prussia was

threatened with an affair with Switzerland, Officers were sent, as is their wont in Prussia, to reconnoitre to see what it would have to meet. Another affair, threatened six years ago, when a second examination was made, and I daresay the reports would be found in the archives of General Moltke. The reports were to the effect, that the Swiss Army—"only a Militia"—was pretty certain to maintain its own against the highly-trained regular Army of Prussia, and, that it was unadvisable to meddle with Switzerland, and it was not meddled with, but left in peace. Now, as to the so-called cheapness of the so-called short service force of our War Office, meaning by short service three years of continuous service. At the present time, I understand, or it was very recently the fact, that you could not get 2,000 men, wanted for the artillery. The report of the men that have been got is, that "they are no worse than they were formerly." That is the best that can be said of them at the time when it is absolutely required to wield the new arm not worse, but exceedingly better for efficient service. At the rate of pay all round, I take those 2,000 artillerymen to cost £100, as rated by the War Office, or £200,000. Now, inasmuch instead of this, as we cannot get the right quality of men, if any at all, at the present rate of pay for continuous service, we paid for such a quality of force as is got for the Irish constabulary, one of the finest military and civil forces that perhaps anywhere exists, perhaps the most trustworthy, whose rate of pay is £70 a man, stores, commands, everything. The nation could not pay or would be disinclined to pay for the continuous service of a whole Army of that force; but it might pay for an amount of training which I apprehend would accomplish the object; that is to say, drill and training, as long or longer, manœuvring as a field force, as complete as any that exists in Switzerland, some thirty or forty days' drill on the Saturday, and paying also for about two weeks of continuous service in the autumn, as a manœuvring field force, just as described in Switzerland, some sixty days in the whole. I have heard very good Officers declare that that amount of service would, with educated, intelligent men, fully suffice. Suppose they were paid at the rate of the Irish constabulary, and got two or three shillings a-day. At that rate, men, even of a higher degree than the Irish constabulary, would be got, men actually earning much more, picked, sober, moral men, who would be induced to come, less for the pay than relief from extra expense. There is no doubt whatever in the minds of Officers who know the labour markets, that a great amount of force of that superior kind would be obtained. What would be the general cost? The cost for the length of time those artillery would serve would be £12 a man, which would be £24,000 as against £200,000, which is put upon us for the inferior pothouse-recruited force, barrack-kept, and barrack-trained, three years' continued-service which is put upon us as a cheap and short-service force. Everywhere the "regulars," the long-continued service force, is beaten by the Volunteers. The scientific corps, the regulars of the artillery, is beaten by the Volunteer artillery, even with the inferior guns which the War Office grudgingly gives them. Statistics show, that the regulars, the long-continued, barrack-trained men, are everywhere beaten in shooting by the Volunteers. Now, what is it that beats but superior education, superior moral and intellectual condition, which gives coolness, steadiness, and precision, as with the educated force in Germany. According to such testimony as that of Captain Wilmot, *V.C.*, the regulars are, as might be expected, beaten, too, in discipline. General Simmons says, that the effect of a picked, educated force in this country would be "marvellous;" and marvellous it will be to those who have not estimated the moral and intellectual elements. I think it will be quite clear that, when all the experience we have had is impartially consulted, they would be a more reliable force in every respect than the pothouse-recruited, barrack-kept forces such as those now recruited; the best that can be said of them being that "they are no worse than they were before." On the surmise which Mr. Hotze has been led to express, that the Swiss system might be unsuitable to Great Britain, the essence of the Swiss system being its localization, I may state that, by most people who have considered this subject of Army Reform, it would be held that, on that very point of localization it would be most suited to us. The social elements he describes, in the autumnal gatherings for continual field exercises, are just the elements that in Great Britain would make the like assemblages attractive to the young

of our population, in counties or districts. It would give to a national Army that localization of force, making it complete, locally, in each arm, which is one of the elements of efficiency in the Prussian Army, but without its compulsion, and without its oppressive long service. I apprehend that the main elements of the Swiss system, that Mr. Hotze has put forth, are entirely applicable without the Swiss element of compulsion, namely, the short service in his sense, not the short service in the War Office sense, the short service which is consistent with productive home work, eight or even eleven months out of the twelve in productive industry for the greatest proportion. all but a very small cadre saved from the wearisome routine, of superfluous and wasteful unproductive occupation in barrack. I take it that the experience of the Prussian Army and of the German Army generally, has been that the men who have been brought from the plough or from the desk, have given better service than the long-continuously barrack-men. I have observed from the War Office a statement, quoted on the authority of Moltke, that three years' service is necessary on the Prussian system. But Prussia, as well as the rest of Germany, will have seen the refutation of this opinion, in equally good service rendered by one-year old men. But much is to be said on the doctrine on that point. The Prussian Army includes very uncivilised, barbarous people, from Posen and other parts, who really have to be educated, to be taught reading and writing, and receive elementary instruction in the ranks, and to have their intelligence evoked. The same is in Austria, where the Officers are the schoolmasters of a large proportion of their rank and file. For that, time may be requisite. But we are talking of another element, of a force already educated, already trained and disciplined and moralised in the elementary school, as in Switzerland. We are talking of a picked, educated, national force. In respect to drill in the school stages, the mistake has been in generalising from Zurich and Berne and a few other places to the whole of the others; but it is to be observed that the military authorities recommended that the national school teachers should all be drilled and have a military training, in order that they may train their scholars. When shall we be taught, as a ground of exclusion in this country, that a man is not to be taken into the ranks who is a debtor, has failed in his duty to his creditors, and is a bankrupt, is not to be trusted to do military duty to his country, and ought not to be associated with its defenders? What a thinning of our ranks such a rule as that would produce!

Mr. KNOX: It would apply to Officers.

Mr. CHADWICK: It would, I apprehend, be of fearfully extensive application, both to Officers as well as to their men. But the Swiss rule is in appreciation of the moral element of force, which is appreciated, too, in Prussia, and one great warrior has said that drill and mechanical force are as one, that morale is as two, and the writers of this paper, I expect, are of the same opinion. It will be a great gain of force in our Army when the Swiss example is in this respect followed, and when the uniform is an outward and visible sign, and a guarantee that the wearer is really a good trustworthy man as well as a good soldier.

Lieut. Colonel FLETCHER, Scots Fusilier Guards: I wish to acknowledge the great satisfaction with which I have listened to the lecture of Mr. Martini and Mr. Hotze, especially as I have had the pleasure of their acquaintance during the trials of the excellent rifle that they have been instrumental in introducing into the Army.

There are a few remarks I should like to make upon what Mr. Hotze has said. In the first place, I think the whole gist of the matter is efficiency, and the point is whether the Swiss have obtained an efficient Army. It seems to me that the question rests in this way. Under present circumstances very large armies are necessary. In former times England, in common with other countries, was contented with comparatively small but very perfectly disciplined armies. Now, under the exigencies of war, and considering the present state of Europe, very large forces are indispensable. Therefore, it becomes a question first to establish what efficiency means, viz., how much you are to require from these forces, and to what standard of excellence they should attain, and, having once established this standard, to fix the amount of drill and discipline required to reach it. Now, notwithstanding what Mr. Chadwick has said, I cannot agree with him that the very short service called for from the Swiss troops is sufficient to discipline and drill an army to the

point to which English troops should reach. In the first place England requires a particular sort of army. It requires one ready for any emergency, that can be put on board ship and taken to any part of the world. I will give as an instance the last two expeditions, viz., that which was sent to Canada during the American civil war, and the Abyssinian expedition. They were both services which necessitated highly disciplined forces, ready to be put on board ship at once, and to land in different parts of the world. Does the Swiss army possess these requirements? To answer this question I think we should look to the report of the Officer who commanded the troops on the French frontier during last winter. A portion of the Swiss army, numbering 40,000 men, was called out at very short notice. This 40,000 were the *élite* of the army, and one would look especially to the report of Baron Herzog as to its condition, and as to the opinion he held of it during the time he was in command. I am given to understand that his report is not favourable, and that he distinctly says that the army required more training. This is a very important point, and I should like to know if Mr. Hotze has had access to that report, and if he knows Baron Herzog's opinion of the army? (Mr. HOTZE: No, I do not.) Then, with regard to the American troops, few people are more calculated to speak of the constitution of the American forces than Mr. Hotze, who served among the first raised volunteers in the Southern States, and took most accurate notes of their formation and training. However, notwithstanding his remarks, I would point out that after the battle of Bull Run, where the South were successful and the North were beaten, both armies were so demoralized, one by their success and the other by their defeat, that neither could move after the battle. Also, from what I observed at a later period of the same war, and I have great respect for the American troops, I am certain that if the Federal troops, at the time McClellan went down to the York Peninsula, had been opposed to highly organized and regularly trained soldiers, they would have suffered even more than they did from the small force of Confederates then opposed to them. Then, again, the Confederate troops which marched to Bull Run were composed of a class of people that could not form the mass of our forces; they were the very pick of the Southern gentlemen, and if, trained as they then were, they had answered perfectly, which I think from the reports of General Beauregard and General Johnston they did not do, otherwise they would have followed up the defeat of the Federal troops at Bull Run, it would be no criterion that a force drilled for only a very short time would be sufficient for the exigencies of England in case of a European war. I have lately had given to me General Faidherbe's proposal for the re-organization of the French army. You all know General Faidherbe commanded somewhat successfully the French army of the north after the surrender of Sedan. He has proposed most extensive reforms. He has spoken out in the most frank and plain manner of the failings of the French army during the present war. He says that France must now have not conscription but universal service, and he puts as the period of universal service two years with the active Army, then service in the First Reserve, and then in the Second Reserve. I quote this as the experience of a man who is entitled to great respect for the way in which he organized the army in the north of France subsequently to the surrender of the regular forces.

There is one other point. I am an advocate for short service, but the limit of that service should be based upon the efficiency to which it is desired to attain. Having done this, the numbers required must be fixed, and the length of service necessary to give efficiency, and to produce reserves. But if we have short service we must have a somewhat extended system of training as compared to that now in force. I think it ought to be a training that would conduce to the making of the men, when they return to civil life, better citizens. If it is for short periods, the young man should be taken between twenty and twenty-three years of age. The service should be regarded as the school of civil life, and if this could once be impressed upon the minds of parents, who now probably dread the Army for their sons because they are afraid of the moral corruption which they consider pertains to a barrack life, there would be much greater facility in obtaining recruits. There is so much that men could be taught. They should not be wearied with drill, because to extend the hours of drill is simply to weary the men without conducing to their

military efficiency. But those three years should be employed in a more special manner for training men for their future citizen life as well as in making them soldiers, and in inculcating into them the real spirit of discipline, which could scarcely be done in the very limited time of service which Mr. Chadwick would approve of.

Captain MONCRIEFF: I agree with the remarks which the gallant Officer (Colonel Fletcher) who spoke last, has made. I find that I can always concur with the views he expresses. I regret, however, that I am quite unable to accept the statements in regard to this lecture, made by the gentleman who spoke first after the lecturer (Mr. Knox). The assumption that we had nothing to learn from the Swiss system, and that this meeting must be perfectly convinced thereof, is surely erroneous. In making his remarks that gentleman used an expression which has unfortunately been bandied about very much; he uses it, too, in the very sense which has led to great misconception in popular opinion upon this subject. He compared the organization of the Militia and Volunteers of England with the organization of the Army of Switzerland. The fact is that these forces have in this country no army organization properly so called, whereas Switzerland has an army, though it is only out for a few days, and is the least expensive in Europe, for it has the organization which makes an army. In this country, on the contrary, we have scarcely got an organization for our regular troops. The Swiss system is doubtless unsuited for England; our own system, if properly organized, is excellent, and towards that end we might study the Swiss system with much advantage. When we consider that the Regular Army of England is barely large enough to form a *dépôt* for the Indian and Colonial forces which may have at any time to occupy the remotest parts of the world, I maintain that it is a most serious question that we should leave the whole home reserve without a proper staff, special arms, or the common requirements of strategical units, and count them only as so many bayonets. Their organization, it must be allowed, does not extend beyond that of the battalion. In making these remarks I should wish to express regret that more important matters have not been brought before Parliament, than the drills and the number of days training of the Militia, or at least the appointment of a Colonel (who is likely enough to have little sympathy with that force) to control a grand district, this will, doubtless, keep the Militia in what is called its proper place. We have not yet begun, I much fear, to give a regular organization to the home Army of England. While the public mind is directed to this subject, I hope and trust that such meetings as these, and such discussions, will lead the public to consider the seriousness of this question, and induce them to urge the adoption of proper measures. Until we can throw a properly equipped army on any part of our coast at short notice, as a Swiss army was lately thrown on the frontier of that country, we have not yet commenced to give anything deserving the name of organization to our forces. I have pleasure in confirming some remarks made by the lecturer in regard to the American army, in which he drew a distinction between their Militia, which was compulsory, and their Volunteers. Before the war broke out I happened to be over a great part of America, and I remarked there, what I am sorry to observe in England also, that the Militia was unpopular, probably for similar reasons. Some of the volunteer battalions, however, had an efficiency in drill which I never saw surpassed. There was, for instance, the 7th Regiment of New York, which turned out some six or seven hundred men in most excellent order. I saw that regiment sent as far as Boston; its conduct would have done credit to any regular troops. It would be easy to make our Militia both popular and confident, as well as more serviceable, by the simple expedient of maintaining a certain portion of the whole force, with an organization and equipment of its own, somewhat equal to modern requirements, and trusting its own Officers to perform, as far as they are suited for it, the ordinary functions pertaining to that organization.

Mr. DICKINSON: I think what we have heard from some gentlemen is an answer to the opinion enunciated by an organ of the War Office, that this lecture would completely explode the old notion of the value of the Swiss system, wherever it was heard or read. I think, on the contrary, it will have the most important effect in

confirming popular prejudice in favour of the Swiss system, so far as I have always heard it proposed to be introduced. What we want our regular Army for, is merely to furnish a foreign contingent to garrison our colonies, and to keep a small nucleus at home. But it is an expensive Army. We have always had, besides the regular Army, a system of Militia as a defensive Army, a home Army, and certainly this lecture will show that we might improve it. We cannot get in our regular Army the numbers we want. I agree with the gentleman who spoke last, that in the present state of Europe we must have greater numbers, and we can only get them as a national Militia. We might train men in our defensive force, if it was so cheap and so little exacting as the Swiss system, and it would recruit the regular Army afterwards. I think the lecturer has done very good service to us at the present time.

Mr. KNOX: I hope I may be allowed to say that the opinions I have expressed are entirely personal opinions, and not in any way connected with the War Office.

Captain RUTLEY: I should like to make one observation with reference to the public schools. Some ten years ago, during the sittings of the Rifle Conference, some members of the Executive Committee, of which I had the honour to be one, made some inquiries with reference to the cadet *corps* of the different public schools. We found that they did not act, as might have been supposed, as nurseries for the Volunteer forces. It was rather the other way. The drill was not compulsory, but in many cases the time devoted to drill was deducted from the boys' play hours. We found, where that was the case, that very few of the boys ever went into the Volunteer service when they left school. It is a point that has been noticed on previous occasions, by several speakers here, and I believe it has attracted the attention of the School Board of London. There was a proposition for introducing drill, attendance at which I presume would be compulsory, into the schools established under the Elementary Education Act. The fact we ascertained ought not to be lost sight of, as it is a subject worthy of consideration; because, if drill is to be compulsory, and the result is to give a distaste for military service, I am afraid the end in view will be defeated.

Mr. CHADWICK: 80 per cent. of the boys volunteer either for the Army or Navy in some district schools.

Captain RUTLEY: It was not so some years ago. I am very glad to hear it.

Mr. CHADWICK: In the Duke of York's School the majority volunteer, though it is perfectly free to them not to do so.

Captain RUTLEY: But they are regularly trained for soldiers. I would rather except the Duke of York's School. I am referring, generally, to the public and large private schools, not a school like the Duke of York's School. I should like to make an observation with reference to a remark that fell from a gentleman, relative to the skill of the Volunteer Artillery. As a Volunteer Artilleryman, I am sure I am very much obliged to him for the very good opinion he has of us. But I think the remark will tend to convey an erroneous impression to this audience if they imagine, because we have had the good fortune to excel the Royal Artillery on one or two occasions in practice, we are at all on a par with them. I think the reason we have been so fortunate is this, that the Royal Artillery alone have no special reward for excellence in practice. In every other branch of the service, in the infantry, in the cavalry—in the Lancers, for instance—the man who excels with his weapon gets either a badge or extra pay. In the artillery there is nothing of the sort. As far as I am aware, the Captain of a battery of Royal Artillery has no means of ascertaining who are the good shots in his command. In the Volunteers it is very different. In the competitions we take very good care to pick our best shots for Nos. 1. I think the absence of reward has had its effect on the practice of the artillery in the regular Army. The practice is got through in a hurry; it is considered a bore by Officers and men, and they fire away a certain number of rounds without any particular care to secure accuracy. That is not the case with the Volunteers. Whenever we go down for practice, we always endeavour to make the best shooting we can.

Mr. KNOX: After the remarks that have been made, I can give a little information that will be pleasing to the audience. The artillery are about to be allowed a reward for their skill in shooting.

Captain BURGESS: Mr. Hotze has mentioned that in Switzerland there are about 60,000 men out in the year. There are 40,000 in the first camp, and 20,000 in the second. Will he give us an account of the camp instruction, whether it is like that taught by the autumn manœuvres of the Prussians?

Mr. HOTZE: The question, as I understand it, is whether the fixed manœuvres of our camps of instruction bear any resemblance to the Prussian system?

Captain BURGESS: Simply, what is carried out in those camps when the men are out?

Mr. HOTZE: The men are kept for two weeks practised in sham battles and regular camp duties. A *corps*, generally of 10,000 men, of all arms, is made to act conjointly, and go through a sham fight and regular camp duties. In that respect it does bear a resemblance to the Prussian system. But as I have never seen the Prussian field manœuvres, I could not speak with any authority on the subject. We have men of all arms out together under canvas, and divided into two *corps*, one of attack and one of defence; and as much as possible in different parts of the country, sometimes east, sometimes south, so as to teach the men different localities; always somewhere near the frontier, towards France, or towards Lake Geneva, especially to teach men the special localities.

The CHAIRMAN: I shall, doubtless, be acting in accordance with the wishes of this meeting by proposing a vote of thanks for the lecture which we have just heard, and which is of the more importance, as it affords us information on the military organization of another country at a time when so much attention is given to that now in progress in our own. The gentlemen who have spoken this evening have remarked upon the analogy between our system and that of the Swiss, or upon the applicability of their system to our Army, our Militia, or Volunteers, and, as well as I remember, by one of the speakers, to our Reserves. Now, without entering further upon this subject, I will mention that if any gentleman will refer to the Local Militia Act of 1812, I think that it is there that he will perceive a real analogy to exist, and there that an important applicability will be found. It appears that our Militia is in process of being fused into the Line, and the local Militia will become, in my opinion, as it was in former times, the best and the proper force to depend upon as a Reserve. In that force the Officers were appointed by property qualification, establishing the important element of the influence of the gentry with localization of the corps, analogous in some respects to our Rifle Volunteers, who recruit for themselves, while men are procured for the Line and the Militia by the exertions of the recruiting serjeant. The local Militia was raised by ballot, and no substitutes allowed; but there were specified causes of exemption. I believe that a very common mistake prevails of confusing the Militia Act of 1802, by which substitutes were allowed, with the Local Militia Act of 1812, in which substitutes were not allowed. By these two Acts it will be seen that, during the war at the beginning of this century, we had two descriptions of Militia—the one, as we should now say, mobilized, wherein the service was with substitution; and the other a Reserve of local Militia, in which the service was compulsory.

I have great pleasure in conveying to Mr. Hotze the thanks of this meeting for a lecture which has elicited many useful observations in the discussion to which it has given rise. Mr. Martini, whose name is so well known in this room as connected with the latest improvements in arms of precision, is present, and I am therefore able to offer to him likewise our thanks for the part which he has taken in the preparation of a lecture which has been so effectively delivered by his friend.

This lecture, when published, will probably be read by all who take an interest in these subjects, and will then become acceptable to a far larger number than those whose thanks I have now the honour to record.

Ebening Meeting.

Monday, May 15th, 1871.

COLONEL W. F. DRUMMOND JERVOIS, C.B., R.E., Deputy Director of Works for Fortifications, in the Chair.

NAMES of MEMBERS who joined the Institution between the 1st and 15th May, 1871.

LIFE.

Hutton, Edward T. H., Ensign 60th Royal Rifles.	Pelly, 'Octavius, Captain, h.-p., Mad. Light Cav., Major Edinburgh Artillery Militia.
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ANNUAL.

Yule, A. H., Lieut. 9th Aberdeenshire Rifle Vols.	Ellice, C. H., C.B., Major-General, Quartermaster-General.
Statham, Harry, Captain 33rd Lancashire Rifle Vols.	Creek, Edward Stanley, Captain 23rd Royal Welsh Fusiliers.
Deane, H. B., Lt. Inns of Court Rifle Vols.	Addison, Charles, Captain 2nd Middlesex Militia.
MacGregor, Sir Geo., K.C.B., Major-Gen., ret., Indian Army.	Page, Samuel Flood, Captain, Adjutant London Scottish Rifle Vols.
Vincent, C. E. H., Ensign 23rd Royal Welsh Fusiliers.	

ON THE NECESSITY FOR A PERMANENT COMMISSION ON STATE SCIENTIFIC QUESTIONS.

By Lieutenant-Colonel A. STRANGE, F.R.S., Inspector of Scientific Instruments, India Department.

THE duty of the Government with respect to science is one of the questions of the day. No question of equal importance has perhaps been more carelessly considered and more heedlessly postponed than this. And now that a hearing has been obtained for it, neither the governing class nor the masses are qualified to discuss it intelligently. The governing class, because it is for the most part composed of men in whose education, as even the highest education was conducted 30 to 50 years ago, science occupied an insignificant place; and the masses, because they may be taken to be virtually destitute of scientific knowledge. Those who wield, and those who confer, the powers of government being alike incapable of dealing with this question, it devolves on another section of the community to urge its claims to attention.

The section qualified to do this is composed of scientific men, properly so called, of professional men, such as engineers, and certain manufacturers who are engaged in applying science practically, and of a limited number of Officers in the naval and military services. This section is without much political influence, but its intellectual power is enormous, and this power has never been so strongly exerted, or so decidedly acknowledged as at the present time.

A tangible acknowledgment of the claims of science consists in the recent appointment of a Royal Commission "On Scientific Instruction and the Advancement of Science," which is now sitting. The problem

which this Commission is expected to solve is one of very great complexity, delicacy, and difficulty. It has to survey the whole world of scientific thought, and to construct a chart on which the districts that it is the duty of State to occupy, shall be clearly delineated, with boundary lines so drawn as not to trench upon tracts which may be best left to individual or corporate management. It has then to devise a form of government of which not a trace at present exists, fitted to administer the affairs of the newly-acquired territories. Instruction in science is one thing, and, I admit, an indispensable thing, without which there can be no foundation for future scientific progress; scientific investigation is another and perfectly distinct thing, constituting the end to which instruction is the means. Each may be pursued separately and solely. But if instruction be scanty, investigation will be unsound; if investigation is neglected, progress must be impossible. It will be for the Royal Commission now sitting to point out the relation of instruction to investigation, and to decide how far and by what agency, the Government may beneficially aid each.

The first Report of the Royal Commission has been published. It deals with certain limited matters of detail only, relating to the occupation of some new buildings at South Kensington. Possibly the settlement of these details may have claimed immediate attention with reference to the arrangement of the buildings in question. This first report has therefore not touched the great problems above adverted to, which await the deliberation of the Commission, and an authoritative solution of which at its hands is anxiously expected by the scientific world.

It may be asked why, as a Royal Commission is investigating the relation of science to the State, the subject of the present paper should be brought forward independently of that body? The reply is, first, that discussions of any of the questions on which the Royal Commission is deliberating can hardly fail to afford light and assistance useful to the inquiry; secondly, that the problem submitted to the Royal Commission is, "How should the State aid science?" whereas the question on which I am to address you is totally different, namely, "How can science aid the State?" Although this latter question may be considered by the Royal Commission, it is certainly not necessarily a part of their programme, and as it is a question of at least equal importance with the former one, it is most undesirable that it should be overlooked.

To the question, "How can science aid the State?" I reply, "By means of a permanent scientific commission or council, constituted for the purpose of advising the Government on all State Scientific questions."

In order to apprehend the aim of this proposal, its practical operation and probable results, it must be examined systematically and in detail. I propose to do this under the following heads:—

I. The scope implied by the term State scientific questions, and the importance of those questions.

II. How are such questions at present dealt with, and with what results?

III. What should be the constitution and functions of the proposed council of science ?

IV. What objections can be alleged against the proposed council ?

I. *The scope implied by the term State Scientific Questions, and the Importance of those Questions.*

In this term I include, first, everything relating to the construction of ships-of-war, and of their armaments, ammunition, and equipments,—to naval sanitary arrangements, and to the employment of the naval service on explorations and scientific researches generally. I include, secondly, everything relating to military ordnance, small arms, ammunition ; to Army equipments of all kinds, to the sanitary arrangements of barracks and hospitals, to the construction and protection of fortifications, and to the employment of the Army for purposes tending to advance purely scientific knowledge. And I include, thirdly, all those questions of science which affect the civil life and well-being of the community, such as drainage, sewage, ventilation, contagion, telegraphy, meteorology, astronomy, surveys, and the physical sciences generally, so far as they are promoted by the Government. Many fiscal and commercial questions of great importance, which have a scientific basis, must also be included.

I have not attempted to specify all the scientific questions that come, or should come, before the Government of a civilized country. They are almost innumerable, and their simple enumeration would occupy the whole of my available space. They may all be comprised under the three great divisions—naval, military, civil.

As to their importance what need be said ? Are an efficient Navy and Army important ? Are the health and welfare of the general community important ? And if they are, then let me ask, have we an efficient Navy and Army at this moment ? Have we ships-of-war that command the confidence of sailors ? Is our naval ordnance beyond any improvement ? Are our land artillery and our military small arms perfect ? I wish to avoid exaggeration. I will not say, as some do, that all these things are, with us, execrably bad ; I will not even say that in many of them we are behind other nations ; my case does not require the support of such extreme opinions. I shall, I believe, be able to maintain my ground by the statement, which few will attempt to controvert, that practical and well-informed men consider all our naval and military armaments, equipments, and ammunition to be susceptible of improvement, and that such improvement can in most cases be effected only by attention to scientific principles. I must add to this another opinion, in which all competent judges will concur, that so long as human knowledge advances, in other words so long as the world lasts, there will be an incessant demand for improvement in these things.

The importance of civil and social questions into which science enters is at least as great as that of the questions to which I have adverted. If it is important that a community be protected from foreign invasion, it is equally important that the health, welfare, and

commercial and intellectual progress of the community for whose benefit costly naval and military forces are kept up, should receive due attention.

We have witnessed an example on the grandest scale, of the successful application of science to war so recently, that, before a naval and military audience, it must be quite unnecessary to dwell upon it. But these events have confirmed a conviction previously held by many who had seriously studied such subjects, namely, that in the present stage of human progress, science is indispensable to national greatness, that the arts cannot flourish, trade cannot prosper, knowledge cannot advance, war cannot succeed with a nation that neglects science. Other things also are necessary, a strong, just, and wise Government, constitutional and religious freedom, love of order and respect for the laws. Without these, also, there cannot be national greatness, but even with these the nation that is not foremost in science cannot be foremost in civilization.

Assuming these opinions to be sound, it is no rash assertion to say that "State Scientific Questions" are of immeasurable importance.

II. *How are such Questions at present dealt with, and with what Results?*

I wish to preface my remarks on this head by saying that they are not intended to apply to any particular party in politics. In speaking of the shortcomings of the Government, I mean to include ALL Administrations, whatever political principles they may have represented. I cannot perceive any difference worth noting between different Cabinets as regards science. All have, in my opinion, displayed, in the most elaborate manner, their incapacity to grasp science as a national matter. I am not aware of a single attempt on the part of any Government that has ever existed in England to define its duties with regard to science, or to model any administrative agency for dealing with it in a rational, efficient, and comprehensive manner. It would be invidious and unjust to single out any set of Ministers as having been more negligent in this matter than others, where all have been to all intents and purposes equally indifferent to it.

How then are State scientific questions now dealt with? The answer is, desultorily, capriciously, inefficiently, irresponsibly, when they are dealt with at all, but in many instances of the greatest moment they are absolutely neglected. The number of questions involving science on which Government has to decide, are innumerable and never ending. Every day adds to their number and their urgency. This vast increase of such questions has taken place within a period which, in the life of a nation, is very brief. At the time of the Crimean War our Artillery was many generations old. No attempt had been made during the time of any one then living to grapple with its defects. Our musket only a few years before was the old Brown Bess of antiquity—smooth-bored, muzzle-loading, lumbering, heavy, inaccurate, and inefficient.

Our Navy was of wood, and steam had only been partially intro-

duced into war vessels. Since that time, a revolution in such matters has taken place. Rifled and breech-loading cannon and small arms, armour-plated steam ships, new projectiles, new ammunition, and new equipments of all kinds have been introduced; but none of these things have been created at once; they have grown by successive stages, and are perpetually growing and undergoing modification; their condition has always been, and still is, one of transition. Foreign nations have entered on the same labour of reconstruction, and there is, therefore, or should be, a keen competition between them and us. In the national advantages of greater wealth, more extensive mineral resources, larger manufacturing power, no people can vie with us. What provision does our Government contain for utilising to the utmost these unrivalled advantages? What are the official arrangements by means of which the administration of the day can successfully apply the discoveries of science to the developing and perfecting of our naval and military appliances, not to speak at present of the multitudinous wants of civil life that clamour for attention?

The reply is that our official scientific arrangements are substantially the same now as they were in the pre-scientific era—they may be more extensive in degree, but they are the same in kind,—the butter may be spread further, but there is not more butter. The enormous scientific activity of the last 30 or 40 years does not seem to have struck the official world as a fact having a bearing on the humdrum routine of the Departments—more secretaries—more clerks—more subordinates of various kinds have been appointed to prevent accumulation of arrears; more committees of inquiry have sat, more scientific witnesses have been examined, more reports published, if not read. But not a single step has been taken towards the creation of an *organization* capable of concentrating and directing all this scattered effort.

The example of foreign nations, the pressure of the public, and the demands of inventors, daily set before the Government scientific puzzles, which they are often, if not generally, at their wit's end to solve. It never seems to occur to them that these puzzles will never cease and that they will increase in difficulty as a matter of absolute certainty. The attempt is made to stave off by temporary expedients work of a permanent character. The puzzles are guessed at, and the guess is oftener wrong than right. Problems too deep for guessing are either pushed out of sight or submitted to methods of investigation that end in a blunder, perhaps a catastrophe.

I do not wish either to declaim or to exaggerate. I will briefly indicate the provision that does exist for the solution of State scientific questions. It is of three principal kinds. First, official subordinates in various departments. Second, temporary and special committees. Third, consultation with individuals eminent in science, or with scientific bodies. I omit debates in Parliament, because no scientific question ever was or will be solved by such an assembly, and I omit also the press, which is so influential in other respects, as altogether unreliable for such inquiries.

The objections to the first kind of provision, viz., official subordinates, are, that such persons have almost invariably other duties of an execu-

tive nature to perform, and have not therefore the leisure necessary for scientific investigation. Science, moreover, is now in a stage in which scarcely any one problem can be adequately grasped by a single mind; this remark particularly applies to State scientific problems, which are invariably of a mixed order, requiring a great variety of attainments for their perfect comprehension. Lastly, subordinates are disqualified for the office of advisers by the very fact that they are subordinates. No inferior can be expected to urge distasteful counsels on a powerful superior, and no superior can be expected to abandon his own preconceived ideas in consequence of the timid and feeble remonstrances of an inferior under his orders. Subordinates then are unfitted to be counsellors, because they must in the majority of cases be deficient in leisure, attainments, and independence.

One clear, decided example of the inadequacy of this source of scientific advice is as good as a thousand. There can be no more apposite example than that of the ill-fated ship "Captain." The design of this ship came from without. Captain Cowper Coles, though a naval Officer, must be considered as a typical independent inventor. He urged his ideas on the Admiralty by every available means, by papers and lectures at this and other Institutions,—by articles and letters in the public journals,—and by interpellations in Parliament. He was, no doubt, actuated by excellent motives. He was of a most ingenious turn of mind, and had a very persevering, energetic nature. But no one has said that he was a man of science. It was perfectly well known to those who knew him at all, that he was nothing of the kind. His inventions were precisely of that order that required strict scientific investigation. They were novel; they involved complex and even contradictory conditions, and they touched the most vital interests of the nation—her naval supremacy. So difficult is the problem which they represent, that although perhaps no such problem ever underwent so much anxious and able investigation, no generally accepted solution of it has as yet been arrived at. This tremendous issue was left in the hands of the Admiralty and its subordinates. We know with what result. It is not my purpose to fix the blame of that result on any individual. It has not, in my opinion, indeed, been brought home to any one in particular. But there stands this indisputable fact that the most recent specimen of English naval architecture, given to the nation under the auspices of the Admiralty and its advisers and subordinates, went to the bottom in an average squall. It is idle to say that no responsibility rested in this particular case on the Admiralty officials. One thing of three must have happened. Either the design was not thoroughly investigated by the Admiralty subordinates,—or, if investigated, it was not objected to by them,—or, if objected to by them, their advice was disregarded by their superiors. Whichever of these was the true cause, the imperfection of the system is equally established. The Admiralty wished to adopt Captain Coles' design, and either the knowledge or the authority necessary to prevent so fatal a mistake, was wanting. Can it be for a moment supposed, that had an established, competent, and independent adviser of the Government pronounced an authoritative No, any Minister that ever lived would

have dared to act in opposition thereto? But there existed no such adviser,—and the ordinary official advisers were either supine or over-ridden,—for the purposes of my argument it matters not which.

The second expedient—temporary Committees—has been very largely employed for the purpose of guiding the Government through their scientific difficulties. There are very serious objections to this expedient. First, there seems to be no rule, either for their appointment or for their composition. If the Government is much pressed by public opinion (which on such subjects is not over-well informed), or if it sees a difficulty ahead, which, however, it often fails to do, a Committee is the result. But there is no guarantee for the proper composition of the Committee. There always lurks about some of the names a suspicion either of incompetence, or of leaning towards the supposed foregone conclusion of the Government. But, passing by such suspicions, there remains the fact, that the members are selected either by some Minister who, not being a scientific man, probably knows nothing about the qualifications necessary for conducting the proposed inquiry, or by some outside and irresponsible person to whom the Minister has applied for help. It is quite overlooked that the selection of the proper persons for conducting any given inquiry can only be made by some one having a knowledge of the subject of the inquiry, or of subjects cognate thereto; the selection is in itself a scientific question. Though some temporary Committees have done good service, it may be safely declared, that on the whole they have failed to give reasonable satisfaction.

A second objection to such Committees consists in the fact itself that they are temporary. As such they necessarily commence their labours, however well they may have been selected, with but a partial and confused knowledge of the question at issue, and much time is lost in gaining some insight into it. After much work and expense, they reach a certain stage in the inquiry at which a report is possible. Perhaps by that time the public pressure or other cause that led to their appointment, has died out, or action is necessary,—in either case the Committee is considered to have served its purpose, and is broken up; the members disperse, take up other duties, the knowledge of a particular subject which they gained in the course of their inquiry is lost to the country, and a scientific problem is left half solved, until at some future day it must be taken up again for completion, and all the old work gone over *de novo*. The system of temporary Committees, in fact, implies a belief that finality is attainable in those mixed scientific problems in which chiefly the State is interested, or that such problems can advantageously be taken to bits and studied piecemeal; whilst the fact is, that no one such problem that can be mentioned ever has, or ever will, as long as human ingenuity survives, come to an end. Permanent arrangements alone can deal with the unbroken continuity and unceasing change of scientific development.

A third objection to such Committees consists in the fact that much of the investigation carried on by several Committees may be common to each. This involves the repetition of the same work, and great consequent waste of time, effort, and money; besides sometimes leading to

perplexing contradictions in the respective results. This would be avoidable if the various Committees were subject to one common authority, and were instructed to avoid needless repetitions of the same or similar researches. But no such common authority exists in England. Scientific Committees work, therefore, as independently of each other as if their respective inquiries could be of no use to any but themselves.

A recent debate in Parliament throws much light on the constitution and functions of such Committees. It related to the Martini-Henry rifle, and took place only a few days ago, on the 28th April. I will cite some extracts.

Colonel Barttelot, in moving for a Select Committee of the House of Commons, said:—"Why for the last 15 years we have been doing "nothing but arming and re-arming, and building and re-building. "Thinking we had found a better method of building ships, thinking "we had found a better method of constructing guns or small arms, "we rushed with precipitate haste to a wholesale execution of the idea "of the moment, and before the idea of the moment had been fully "embodied, at vast public expenditure, some superior inventions were "brought forward, and the whole thing had to be done over again."

These words illustrate my last remarks. In another place he stated:—"The House was aware of the enormous sums which had been "expended upon the trials of various weapons, and from a return "which he had obtained he found that £232,227 had been given as "rewards to inventors of ordnance, and £80,124 to inventors of small "arms. Those sums, however, did not include the cost of the experi- "ments entered into to try the value of these different arms, which "had amounted to an enormous sum. For instance, no less than a "million of money had been expended upon the 4-ton 7-inch Arm- "strong gun for the Navy, which, after all, had been condemned. And "the country was now to be called upon to sanction an expenditure of "three or four millions upon a weapon, the value of which was, at all "events, doubtful."

And, again, speaking of the witnesses examined by the Committee, he said:—"When gentlemen received a fee of 50 guineas—for that "was the sum paid to those witnesses—although he admitted that they "were men above all suspicion, yet they would naturally be more "inclined to advocate one side of the question than the other, if they "possibly could."

Lord Elcho, opposing the Select Committee of the House, and defending the Martini-Henry Committee, of which he was a member, gives this account of its origin, constitution, and functions:—"Prussia "had used breech-loading arms to suppress the revolutionary movement "of 1848, but it was not till 1866 that steps were taken to supply our "Army with a breech-loading weapon. In that year General Peel, "then Secretary for War, offered three prizes—one of £1,000 for the "best combination of qualities in a military rifle; another of £600 for "the best breech-loading arrangement; and a third of £400 for the "best ammunition. An invitation was sent to a number of gunmakers, "and 105 responded to it. In March, 1867, a Committee was

"appointed, consisting of Lieutenant-Colonel Fletcher (President), Captain Rawlins, Captain Mackinnon, Earl Spencer, Mr. Edward Ross, and Captain Hay, of the Royal Artillery, who was Secretary. This Committee reported in 1869."

It issued five Reports, which his Lordship described; he then proceeded:—"The powers of the Committee were then extended, so as to enable them to examine and report upon the best arm for the service."

After describing the Reports that followed this extension, he said:—"Immediately after this, two minor Committees were appointed, one consisting of military members of the original body, to consider such questions as those of bayonets, muzzle-stoppers, and the rest, and the other to report upon the powder best to be used, and other similar questions. The second great division commenced with the appointment in May, 1870, of the Committee with which rested the final decision."

There seems to have been a perfect jumble of Committees.

But the most remarkable fact concerning the composition and functions of this very complex Committee is thus described by his Lordship:—

"When it was proposed to him to serve on the Committee, he stipulated that the best and most decisive scientific and mechanical authorities should be invited to examine the breech action. The question arose who should be on the Committee, and he recommended Mr. Gregory, President of the Institute of Civil Engineers. Mr. Gregory was added to the Committee, and was consulted as to the scientific witnesses who should be examined. He recommended Mr. Bramwell, Mr. Nasmyth, Dr. Pole, and Mr. Woods as scientific men, and Colonel Dickson, Mr. Perry, a practical man from Enfield, Captain Beaumont (South Durham), and Mr. Martini were also added to the list. It occurred to him that the scientific evidence would be overhauled, and he asked Mr. Gregory the grounds upon which he had recommended these gentlemen to the Committee. Mr. Gregory replied that they were not only men of high scientific character and distinguished antecedents, but also of different orders of mind and methods of treating the subject."

From this it is clear that the scientific element in this scientific Committee was quite an after-thought, due to Lord Elcho's sagacity.

I gather from the expressions "the best and most decisive scientific and mechanical authorities," and "the scientific witnesses," and from the fact, which can hardly be gainsaid, that the witnesses named above were more conversant with mechanical and scientific subjects than the members of the Committee, that the Committee was expected rather to collect evidence than to investigate for itself and arrive at its own independent scientific judgment. If the Committee was fully qualified for the task, which is nowhere asserted by Lord Elcho, it would not have required the assistance of scientific witnesses; if it were not qualified, neither would it be competent to elicit and sift evidence on a subject on which even scientific opinion might be expected to differ very widely. It appears to me that the witnesses,

or persons with their special qualifications, should have composed the Committee.

The next speaker was Mr. Bass, who said, with perfect truth, "The question was certainly one of a purely technical character, and no one could thoroughly discuss it who was not master of all the technical details;" adding, "It would not be easy to find a higher authority upon it than Mr. Whitworth, and he was informed that Mr. Whitworth was totally opposed to the rifle under consideration."

Another speaker, Mr. Malcolm, justly "ridiculed the proposal for referring this question to a Committee of that House, who would merely be able to weigh the evidence of the gunmakers on the one side or the other. No Committee of that House could afford the time for going down to Woolwich Marshes and practically testing the rifles in every possible way;" which, however, was all that the original quasi scientific Committee it appears was expected to do.

Colonel Jervis, a high authority, then remarked:—"These inventions were constantly cropping up one after another; improvements rapidly followed on each other; and he believed it would be many years yet before they got what might be called a perfect weapon," a remark which strikes at the very root of temporary Committees, though no substitute for such Committees is hinted at by this or any other speaker in the debate.

It is noticeable that speaker after speaker in the debate questioned the fitness of the House of Commons to discuss a technical question. There was an evident dissatisfaction with the decision of the Committee, and a desire to revise it, yet no one could point to a tribunal qualified for the task. It was well known to all that no such tribunal exists in England. But the dilemma suggested no remedy to any one. Nothing was left but either to accept the distasteful decision of the Committee or to appoint a Select Committee of the House; and the latter measure, as a self-evident absurdity, was very properly negatived by a large majority. The Martini-Henry rifle, therefore, for the present stands its ground in spite of considerable opposition and distrust. It is not my purpose on this occasion to give my own opinion on that rifle. I aim at a much larger and more important object. Nor do I intend in the most remote manner to question the zeal and fairness of the Committee. I seek a different lesson from this particular example—one quite apart from individual matters of any kind.

What I learn from it is this—that temporary Committees, as usually constituted, have not the weight of authority necessary to command public confidence, and that the work they are set to do is not temporary work, but continuous work, needing perpetual revision, and never coming to an end.

I come now to the third source from which the Government draws its scientific inspiration, namely, individuals eminent in science and scientific bodies. Recourse is had to such sources without any system whatever; there exists no rule, for instance, defining what cases should be submitted to an individual, what cases to a scientific society, and what cases to a temporary Committee. Nor is it possible to assess the

degree of responsibility attaching to an individual or to a scientific society advising the Government. If the advice so obtained is rejected, nothing about it is known publicly; if it is adopted and turns out unsound, the right to blame the adviser is absent. It is impossible to ascertain when such consultations have occurred, and with what results. The probability is that they are not frequent. During the two years that I served on the Council of the Royal Society, I only remember one application from Government for advice. It was on some point connected with coppering ships. A committee was formed of the most competent persons, and probably very sound counsel was afforded. But it is evident that this is an expedient that cannot be frequently employed, as it would occupy too much of the time of the Society which should be devoted to its legitimate objects. Advising the Government is certainly not one of these, nor should the Government of a great, powerful, and opulent nation like England be reduced to such makeshifts as private societies for direction in matters of such tremendous national moment.

Having shown, I trust, that Government is without recognised scientific advisers, I proceed to discuss :—

III. *What should be the constitution and functions of the proposed Council of Science?*

The ground requires to be cleared before approaching this question. I have heard it urged that the various Departments of the State should be complete in themselves, each with its own consultative element, as distinct from its executive. This appears at first sight a plausible arrangement, but it will not bear examination. Many of the scientific inquiries that devolve on the Government affect several departments, and in such cases it would be wasteful to have numerous repetitions of the same investigation when one would do; and if, under the supposed arrangement, one investigation of a given class of subjects was decided on, the selection of the particular department to which it should be referred would cause endless bickerings and jealousies,—the co-operation of Departments being, like universal peace, a somewhat remote hope. Again several Departments would require identical scientific advisers. For instance few Departments could dispense with a chemist; a number of chemists would have to be employed where one or two would suffice. And further it would be found necessary to provide for each of the Departments requiring scientific advice, representatives of several branches of science. The aggregate number of scientific advisers would be enormous if each Department were independently efficient. Finally such a system would not be homogeneous, and would be found very difficult to work practically, on account of the diversity of decisions that would occur on questions more or less identical. There would then arise, just what has now arisen, want of a final court of scientific appeal to reconcile discordancies and give certainty to the action of the executive.

For these reasons I discard this suggestion, and revert to the proposal which forms the subject of this paper, namely, that there should

be one permanent great Council for advising and assisting the Government on all State scientific questions. This Council should be purely consultative, not executive. All Departments should equally be entitled to its assistance. The Council should not be expected to initiate questions, though it might occasionally see fit to propose certain investigations to the Government, without whose sanction, however, they should not be undertaken. The Government should not be bound on all occasions of scientific difficulty, either to resort to, or be guided by, the opinion of the Council; but it would of course become in either case absolutely responsible for all consequences.

The proceedings of such a body would embrace a vast field. Since there is no branch of science with which the Government does not at some time or other come in contact, every well-defined branch of science should be fully represented on the Council. There would require to be pure and mixed mathematicians, astronomers, surveyors, chemists, physicists, engineers, physiologists, physicians, surgeons, naturalists, geologists, meteorologists; for some of these subjects two or more representatives of their different subdivisions would be needed. The naval and military services of all arms, and the commercial element should also be present. Probably not less than 50 members would be required for thorough efficiency. The Council of the Royal Society numbers 21 members, and this body takes little or no cognizance of naval and military questions, nor of those relating to public health, except indirectly, as illustrating philosophical views.

The Council would conduct its business by means of working sub-committees, into which it would divide itself for specific purposes. The reports of such sub-committees should be submitted to the whole Council for general discussion, and the responsibility for the advice ultimately tendered to the Government should rest on the Council as a whole, not on the section or sub-committee with which it might have originated. This mode of working would insure dispatch of business, special aptitude in the investigators, and large views derived from a great variety of attainments and habits of thought. Decisions thus matured could not fail to command public confidence.

The duties that would devolve on this Council, stated broadly, would be—

1st. To advise the Government on all questions arising in the ordinary routine of administration, submitted to it by the various Departments.

2nd. To advise the Government on special questions, such as the founding of new scientific institutions, and the modification or abolition of old ones; the sanctioning of scientific expeditions, and applications for grants for scientific purposes.

3rd. To receive, consider, and decide upon inventions tendered to Government for the use of the State.

4th. To conduct or superintend the experiments necessary to enable it to perform the above duties.

As to the first branch of its duties little need be said. The number and variety of questions involving scientific considerations entering into the current work of the different Departments are almost unlimited.

A large proportion of them could be answered at once by competent persons, but there would remain many that would require investigation, discussion, and often experiment.

The second branch, special questions, would not perhaps be so extensive, but it would be exceedingly important. At present there exists literally no provision for dealing with such questions. Sometimes one person, supposed to have a knowledge of the matter at issue, sometimes another is consulted, sometimes no one. At present the Royal Commission now sitting is probably dealing with the subject of existing and required scientific institutions. But supposing this body settles all such matters in the most satisfactory manner at the present time, a reconsideration of them will very soon be demanded by the rapid advance of science, and the perpetually changing relations of different lines and modes of physical inquiry. But the Royal Commission is a temporary body. Its functions will sooner or later cease, whilst the mutations and permutations of scientific thought are incessant. Questions relating to State scientific institutions require ceaseless watching,—never-ending modification. A permanent body, such as I propose, alone can preserve the national scientific establishments in a condition of vigorous efficiency on a level with the existing state of physical knowledge.

The sanctioning of special scientific researches and expeditions will be a very important duty, which there is at present no one qualified to perform. Last year, when the aid of Government was desired for the Solar Eclipse Expedition, this want was strongly felt. The men of science went first to one Department and were snubbed by it; they then tried another, from which they did not receive even a snub, their communication being totally ignored. Ultimately, a private individual obtained by personal influence an interview with the Chancellor of the Exchequer, and succeeded in inducing that Minister to sanction an object with which his particular Department had no concern. Had there been a Department for Science, none of this fumbling would have occurred; but as it was, the expedition was almost rendered impracticable by delay, and its object was only attained through the strenuous exertions of a few energetic private individuals voluntarily devoting their time to the purpose.

Analogous to this is the case mentioned last year at a conference at the Society of Arts* by Lord Henry Lennox, that recently "wishing to ask a question in the House of Commons as to the National Collections, he found that, if he put his question at all, he must put it to four or five different Members of the Government, and perhaps to one gentleman who was not a member of the Government at all. He therefore was obliged to put his question to the Prime Minister, as representing the collective wisdom of the Government, although those who really had to supply the answer, were sitting around him." I question whether the state of things here described exists in any civilised country but our own.

Sanctioning of grants of money for aiding scientific objects comes under

* "Soc. of Arts Journal," 8th April, 1870, p. 454.

the same head as sanctioning expeditions. At present £1,000 per annum is granted by Government for such purposes, and it is distributed by the Government Grant Committee of the Royal Society. As a member of this Committee I can testify to the extreme care, fidelity, and impartiality with which it performs this gratuitous duty. The amount of the grant might with advantage be much increased, as at present only small sums can be given out of it to each applicant; these are often quite insufficient, and as they must unavoidably be small, no application for aiding extensive and costly researches can expect efficient aid from so narrow a source. The proposed Council would be a public body, precisely qualified to perform the duty now imposed on private individuals.

The third branch of duties devolving naturally on the Council would be the dealing with inventions tendered for the use of the State. Perhaps my views on this point will not lose force from the fact that I have never tendered inventions to the Government, and am not personally interested in any such. No duty which I propose to assign to the Council is more important than this. At present the different Departments are inundated with inventions, which there is no one possessing both the needful qualifications and the requisite leisure to grapple with. They should be relieved of this oppressive labour and responsibility. It is quite notorious that both the Departments and the inventors have great ground for complaint. The Departments because they do not possess machinery adequate to cope with the flood of inventions, and inventors because their proposals often do not and cannot receive fair attention.

Inventions offered to Government may be classified under two principal heads—the mature and the embryo. The mature inventions require judgment to be exercised as to their acceptance or rejection—a contrivance good in itself may be unsuitable to the policy of the Government, or to the conditions with which it would, if adopted, have to be combined, as, for instance, a particular kind of gun might not suit the class of ships then building. With this order of invention only a mixed body of professional and scientific men could satisfactorily deal.

The second order—the embryo inventions—include every imaginable conception, from the utterly valueless crotchets of visionaries to germs of the most magnificent promise. Can any one pretend for a moment that we possess the means of sifting patiently and discriminately the heterogeneous mass of suggestive ideas that the most inventive people in the world are daily accumulating?

The ordinary official view of the matter is that individuals must be left to work out their own ideas. In many, perhaps in the majority of cases, that may be true, but now and then a suggestion may come from one too poor to work it out, which, if the powerful resources of the State were applied to it, would turn out to be of priceless value. Should we despise the pearl because the search for it is laborious?

All inventions offered to the State should come before the Council of Science, who should advise the Government as to the adoption of some, and as to aiding in the development of others. The examination to

which such a body would subject such proposals, though it would probably not satisfy each individual projector, would certainly satisfy the nation that this wide and creative sphere of its intellectual supremacy was receiving fitting attention—no such satisfaction at present is felt.

Again, though many inventions are adopted by the State, the inventors do not always receive liberal treatment. At present, as the law stands, the State has a right to the free use of a patented invention, and this seems necessary. But the State properly admits that the proprietor of a useful patent, thus adopted, should be remunerated. Theoretically that seems very fair, but practically the amount of the remuneration is fixed by the Government or by the Department using the invention, and this amount is often niggardly in the extreme. If it were fixed by an independent and highly-qualified body like the proposed Council, a nearer approach to an equitable arrangement of such matters would probably be arrived at.

It is impossible to speak of inventions without suggesting thoughts of patents. I propose to say very little regarding these monopolies, because a discussion on our Patent Laws is very far from being the object of my present address. Though very divergent views are held on the subject, all are, I think, agreed that our present patent system is glaringly defective, neither affording to inventors due encouragement and security, nor to the community generally adequate legitimate advantages. The question how to improve this most unsatisfactory system is one of extreme difficulty, involving a multitude of nice legal points, and of equally subtle scientific considerations. The judges say that the problem cannot be solved by themselves singly, and that special scientific aid must be afforded them. Where is this to come from? Whence could it come with such authority and impartiality as from the Council, whose creation we are now considering?

The 4th class of duties which the Council would have to perform would relate to the experiments and investigations necessary to enable it to perform the duties previously enumerated. Regarding the necessity for providing the Council with the agency, appliances, accommodation, and funds requisite for these purposes, there can hardly be two opinions. They are absolutely indispensable. I need not here attempt to define what would be wanted. Such details would follow naturally the affirmation of the great principle involved in the creation of the Council.

I come now to a question on which opinions may differ—namely, the question, whether the Council should be a paid or an unpaid body. I say, unhesitatingly, that it should be handsomely paid. If the heads of duties to be performed, of which I have given but an outline, be duly considered, it will be seen that they will be laborious, responsible, and beneficial in the highest degree; and that they can only be adequately performed by highly-qualified persons. It is idle to expect that such men as will be necessary, will devote themselves almost exclusively, as they will have to do, to such labour from pure love of science and of their fellow-creatures. The delights of philosophical speculation are one thing, carrying with them their own reward—a

reward beyond any money consideration; downright official routine work is quite another thing. In no other professional field is it unpaid; nor is it ever worth much if not paid for. It has hitherto been too much the custom to treat men of science as exceptions to all other professions; to assume that whilst it is quite proper to enrich and ennoble soldiers who fight for pay, lawyers who evade or apply the law according to circumstances, physicians who kill or cure as seemeth best to them, and even divines, whose mission to save souls might be deemed a sufficient privilege, the man of science who contrives the arms with which the soldier won his fortune and his coronet, who surrounds the lawyer, the physician, and the divine with the luxuries which their superior privileges enable them to command, should work for love, and die, as he too often does, in poverty.

If the Council, the creation of which I now advocate, does its duty, it will confer benefits untold on every member of the community, from highest to lowest; from the military and naval appliances necessary to protect our unequalled national wealth, down to the smallest and least regarded necessities of our ordinary life, the influence of this Council will be felt; and is it either just or wise to expect such benefits for nothing?

The salary that I should recommend as appropriate would be £1,500 per annum to each member of the Council. It may be urged that there will be no guarantee that these offices will not become sinecures. Of course neglect of duty may happen here as elsewhere; but care in selecting the members will afford some hope that they will be men of honour, and, as a rule, true men of science are seldom idlers. But an incentive to work may be given by the principle adopted on boards of public companies—namely, payment according to attendance. I need not, however, dwell on such matters of detail.

My sketch of the proposed Council will not be complete without some indication of the mode of constituting it.

The two characteristics which it is most essential to ensure are high qualifications and the most entire freedom from political bias. The members would probably be of three classes—1st, ex-officio members, being heads of certain existing State scientific institutions, such as the Astronomer Royal, the Director of the School of Mines, the Mint Master, &c.; 2nd, military and naval members; 3rd, scientific members, not of either of the two first classes.

Regarding, 1st, the ex-officio members, nothing need be said. The election of the 2nd class might be initiated by that part of the corps to be represented then serving in England, as for instance the Engineers, the Artillery, or the Navy. The arm of the Service requiring a member, should select four names; these should be sent up to the Council, who should reduce them to two; and of these two the Government should be bound to appoint one, without power to reject either of them, or to substitute a nominee of their own. For class 3, the scientific societies would form the best constituencies; and the election might be conducted in the same manner as that of class 2,—four names being first selected by the Society whose branch of science had to be represented, these reduced to two by the Council itself, of whom one

should be appointed by the Government. In this way each arm of the Service or branch of science would be represented by a person in whom they had confidence; the Council, itself powerfully interested in the efficiency of its colleagues, would have a voice in their election, and the Government would also participate to a moderate extent in the ultimate result. I do not give this as the only or the best form of election, but as one of many feasible forms by means of which an efficient body, free from suspicion of subserviency to the Government of the day, may be constituted.

I come now to the last division of my subject.

IV. *What objections can be alleged against the proposed Council?*

Difficulties innumerable can of course be conjured up in this as in every case of reform, but I have only heard three definite objections raised that seem to me to deserve any notice. They are:—

1st. That this is a system of centralization, and therefore objectionable.

2nd. That it will be liable to jobbery.

3rd. That it will be too costly.

I will touch on each of these briefly.

As to centralization, I admit the impeachment, but claim it as an advantage, not an evil. Those who are scared by centralization forget that it constitutes the very basis of civilization and of stable efficient government. In primitive savage life there is no centralization, no united effort for a common purpose. Each individual struggles single-handed for his rights. Civilization teaches us to set apart certain members of the community for purposes beneficial to the whole, to form them into distinct bodies, having definite duties to be executed, under the direction of a head central authority. The Army, the Navy, the police, the post-office, are examples of such bodies, the animating and ruling law of which is centralization. In the case of the police, we have local, in the other cases imperial, centralization. The body we are considering will have to perform duties of a strictly imperial character, contributing directly to the efficiency of the defensive power of the empire, and to the security and well-being of every member of the community. It is a body which not only would not be effective, but which could not exist but in a centralized form.

As to the second objection, that the arrangement I have proposed would be liable to jobbery, I must own that, as I contemplate the employment of human beings only, I do certainly expect to see the operation of human motives. But if jobbery be a fatal objection to the scheme, then on the same principle we ought to have no Army, Navy, church, bench, magistracy, municipalities, or Parliament, for in each of these the discovery of some traces of jobbery will probably reward a diligent scrutiny. It is not apparent why a degree of purity not dreamt of in regard to any other profession should be insisted on when science is in question; nor is it clear why men of science should, *à priori*, be deemed more corrupt than their neighbours. Of course

every precaution should be taken against corruption in so important a body, and the rest must be left to that sense of honour to be found in all other professions, and of which even men of science are perhaps not entirely devoid.

The third objection, undue costliness, is, in my opinion, as invalid as the other two. My proposal has two main objects—to increase efficiency, and to diminish blunders. Both are in the strictest sense economical objects. If it does not seem calculated to attain these objects, it should on no account be adopted. If it gives satisfactory promise of their attainment, no expenditure that it is likely to occasion will be too great in order to secure them. Let any one who is terrified by the cost, visit our ports, dockyards, and arsenals, and there see the ships that have been built which should not have been built, the canons made that should never have existed, and the useless arms and equipments of the pre-scientific ages. Let him count the cost of these, and compare it with the probable cost of substituting for the reign of haphazard ignorance, a reign of systematic intelligence. To take one example—that of Her Majesty's ship "Captain." This vessel, with her armament and stores, probably cost the nation three or four hundred thousand pounds. Who shall assess in money the value of the 500 noble lives that perished with her? Would not the nation willingly give a million to have them back? If so, we have as the cost of one single blunder committed by one Department something like a million and a half of money, a sum that would go a long way to permanently endow a body which, had it existed a year ago, must have prevented that blunder. But if I dwell on the preservation, prolongation, and increased comfort of civil life which such a Council would certainly tend materially to secure, the cost of its maintenance would appear absolutely insignificant in comparison with the blessings it would shower on the nation. Against the cry of costliness I oppose the assertion, easily established, that nothing is so ruinous as disregard of the laws of nature, and nothing so profitable as intelligent obedience to them. Science, looked at in the dryest commercial spirit, must, in the long run, *pay*.

I must guard myself against the supposition that the proposal I have here advocated comprises all that is necessary for the efficient administration of scientific State affairs. It is only one part of a great system that has to be created. Other parts of the system will, no doubt, receive due attention from the Royal Commission now considering them. But there is one part so important that I feel called on to name it; I mean the appointment of a Minister of Science. He need not necessarily be exclusively devoted to science; he might, perhaps, with advantage, have charge of education and the fine arts also; but some one in Parliament directly representing the scientific branches of the national services has become absolutely indispensable. Another urgent want which, as its scientific character is not purely physical, will probably not be dealt with by the Royal Commission on Science, is that of a High War Council—a Council of Naval and Military Officers of the greatest professional attainments and distinction, constituted for the purpose of advising the Government on the highest

problems of strategical science. At present we have not a vestige of anything of the kind, and are consequently, as a military nation, almost destitute of the basis of the military art.

No one could have heard the admirable lecture on our "National Defences," delivered at the Royal Institution on Friday last, by the distinguished Officer who has done us the honour to preside here this evening, without being struck with our deficiencies in this fundamental desideratum, or without asking himself the question on whom should devolve the duty of constructing and propounding the broad outline of our military defensive tactics. I will name only one question of the deepest importance, the solution of which has not yet been seriously attempted, much less reached—namely, what position in our defensive system are the Volunteers to occupy in the event of actual war? This question is only one of multitudes, equally momentous, that would occupy the attention of such a High War Council as I have incidentally referred to.

The present seems an opportune time for considering the question before us. The administration of the Admiralty and the construction of war vessels are undergoing investigation—the Army is being re-organized—and we have been strongly impressed with the efficacy of science and system in the Prussian Army. The public mind is now as ripe as it probably ever will be for the reception of the idea, that the cost of our Army and Navy is more likely to be diminished than increased by due attention to the conditions on which efficiency depends.

When we have all Scientific National Institutions under one Minister of State, advised by a permanent, independent, and highly qualified consultative body—when we have a similar body to advise the Ministers of War and Marine in strategical science—then the fact that, in accordance with our marvellous constitution, these Ministers must almost necessarily be men without pretension to a knowledge of the affairs which they administer, need cause us no alarm. When these combinations have been, as they assuredly will be, sooner or later, effected, the wealth, resources, and intelligence of the nation, having due scope, will render us unapproachable in the arts of peace, and unconquerable in war—but not till then.

In conclusion, I must claim for the proposal I have advocated that there is nothing revolutionary in its character.

I aim at creating no new principle. We have already, as an integral part of our administration, a body constituted on the very same principle as that now advocated. I allude to the Council of India. In a debate which took place in the House of Lords only four days ago (Thursday, May 12), the Duke of Argyll, Secretary of State for India, spoke as follows:—"It should be borne in mind that the Government of India was nothing more nor less than a standing Royal Commission for the administration of the affairs of that country. And how was that Royal Commission composed? Of some of the ablest men who had worked their way up to important positions in India, of English statesmen, and of men who were acquainted with legislative work in this country."

Now consider for a moment why and how this India Council—this *standing Commission*, as His Grace appropriately calls it—was constituted. It was seen, on transferring India to the hands of a Minister of State that, according to our political system, the holder of that Office would not necessarily possess any special knowledge of India and its peculiar usages and inhabitants. It was felt that such a country could not be governed safely without this special knowledge, and the want was supplied by the appointment of a Council containing many experienced Indian civil and military Officers. That Council has now existed for several years, and has aided with its advice many Secretaries of State belonging to various political parties. Not one of these—no one competent to speak on the subject—has disputed the necessity for that Council. Its creation is admitted on all hands to have been theoretically wise, and its working practically efficient and beneficial. And remember that this Council is, as it should be, handsomely paid.

Now compare the case of India with the case of science. Dissimilar though they may at first appear, there exists between them a most striking and close analogy. Substitute for the peculiar languages and usages of the people of India, the peculiar language, methods, and principles of physical science,—is not special knowledge in the one case as indispensable to efficient administration as in the other? Then compare the Secretary of State for India with those Secretaries of State who are most concerned with scientific questions,—are the latter ever selected on account of their scientific knowledge? Would it be possible, according to our political system, so to select them? Take the Right Honourable Gentleman now filling the arduous post of First Lord of the Admiralty,—does any one suppose, or does he himself pretend, that he is conversant with naval architecture and naval ordnance? The very contrary is avowed and justified. It is a principle with all parties in politics that the Admiralty should be presided over by a civilian, and that administrative abilities alone (whatever they may be) are a sufficient qualification for the post. I am not contending that this principle is wrong. I am not at present concerned with that question. I am merely asserting that it rules,—and I then say that the civil First Lord is precisely in the same condition as to naval scientific knowledge as the Secretary of State for India is with regard to special Indian knowledge,—but the latter has a highly and specially-informed independent body to advise him, whilst the former is left to his own devices and to such counsel as his executive subordinates may be able to afford him,—the loss of the “Captain” tells us with what probable consequences.

But the Admiralty is only one department. All departments equally need, at some time or other, many of them constantly, special scientific guidance, and for none of them is there any provision that can for a moment be compared with the assistance afforded to the single department for India by its “*standing Commission*.”

My proposal, therefore, I maintain, aims at the creation of no new principle,—but only at the extension of one already existing, and universally approved after long experience. Nor do I aim at creating new labours. The work of which I have been speaking, is now being

done or supposed to be done, and it is paid for heavily by the nation, but it is not well done. I propose to improve its quality by improving the agency to which it is assigned. I propose to substitute concentration for scattered effort, system for chance, organization for disorder. I propose neither to exact from the Queen's advisers new duties, nor to fix upon them new responsibilities. The end and aim of my proposal is to lighten their labours and anxieties by putting into their hands better arms than those with which they now vainly strive to uphold the power and the glory of the nation.

The CHAIRMAN : It appears impossible to overrate the importance of the principle which has been enunciated by Colonel Strange in his able paper. Many questions may arise in the application of that principle, and I think I see several gentlemen here who will be able to afford advice as to the manner in which it should be applied. If any one will favour the meeting with their observations, we shall be very happy to hear them.

Mr. SCOTT RUSSELL, F.R.S. : I did not expect to be called upon for any observations, but I could not help taking notes as Colonel Strange went on, of what seemed to me to be the very good things he was saying. But now I will give my impression of his paper in one word, that it is a great deal "too good to be true." He said he was content with human beings. Now, I am afraid we must wait till these English human beings have got wings before we can quite attain to the perfection he has so seductively pointed to. As I entirely agree with him in the national importance and value of all he has recommended, I scarcely know where to begin the remarks I can make upon the subject. Having said this, I would rather point out what the difficulties are in attaining an object so desirable. Now, the first difficulty I have noted down is this—that it seems to me a very revolutionary paper, and quite contrary to all the habits, prejudices, and opinions of the English people, and, above all, to their political doctrines. We do not like science; we like practice. We do not like system; we like leaving to each man to do the best he can for himself. We detest State organization; we require the fullest possible liberty for every individual to pursue his own interests, and his own whims in any way he likes; not controlled by patriotism or common good, or any of those ideal things. Now, all these make this a revolutionary and a highly un-English paper. There is, however, some ground for agreement with Colonel Strange. I will give you one or two of the points in which I think we may agree with him. We might agree on letting a little science now-a-days into our practice. I think we might, because science means knowing before-hand, and practice means knowing after-hand. And I think it has become rather important in what is not the pre-scientific era, that we should learn to be able to do things before-hand instead of afterwards, especially in matters of war, and especially in sending ships to a stormy sea. On these points I will venture one or two remarks. In the first place, I remember going to Prussia in 1849, and being astounded for the first time to learn that in Prussia science was allowed a place in practice not only in common life, but in the affairs of government. I was perfectly astounded at this; it was something quite new to me. I learnt there that there were colleges and universities in which common craftsmen learned their trades. That was a horribly revolutionary idea. I found there was an exquisite arm called the needle-gun. I gave myself the trouble of studying the needle-gun. I came home, and I afterwards went to the Minister of War, and I said, "Sir, do you know what a grand instrument they have got in Prussia that you have not got?" "Oh," he said, "I have heard that, and we have often tried to get at the secret." I said, "I know the secret." "Very well," he said, "I would be much obliged to you." I said, "I will tell you what I will do; I will go and tell an English gun-maker to make a dozen of them; I will send for a fellow who knows how to use them, and you shall know all about it." The Minister of War kindly condescended to allow me to do that. I did that. I sent for a man who knew the use of the gun, and he did wonders. Then

the Minister of War returned me this cutting verdict, to say no more upon the subject, "That he had ascertained that the needle-gun fired so quickly, that the "men would empty their cartridge boxes long before they had finished the battle." That was the end of that. In the same manner I have sometimes ventured to suggest to Lords of the Admiralty and Constructors of the Navy, that it would be a rather good thing, instead of drawing upon ship's plans what we call water lines, which you know are beautifully straight, horizontal lines, keeping just where they ought to be about the sides of a ship, that before a ship was decided on being built, they should put her on lines called wave lines, which represent the shapes those waves take at sea. Because, though practical men will tell you that waves are unintelligent, that they are irrational, that they do all sorts of impossible and inconceivable things, yet it does turn out that the water, even in its wildest storms, is a little rational, and that it does keep to certain agreed but very ugly lines. And you have only to put your ship upon those very ugly lines, and you would see at once what a storm will do to your ship when she goes to sea. That is a revolutionary idea, and has not up to this moment been much put into practice. There is another reason why this proposal of Colonel Strange will not be adopted. System is a horrible disadvantage to personal power. System means continuous, reasonable method, and the following out of plans settled before-hand. Now, if I were a political man, knowing nothing whatever of this thing, and were I to come into power, and find the lines of method and reason and system all laid down before, I ask you, how am I to indulge my love of power, my desire to act, my feeling of independence, my liberty, my ministerial function? I find everything systematically arranged before, and the best thing I can do is to abstain from meddling with things I do not understand. I say that would be an intolerable condition on which to accept power; and speaking as a political man, I do not think any political man ought to accept power from you under such circumstances. One point more. Organization by the State we detest. We call it State interference. Now, I find that the interpretation of this word, State or Government interference, differs in different countries. I find that in countries that have been long governed by arbitrary government, State interference is a very terrible and detested thing; that where the same class has long governed the country, State interference means the government by that class for its own special benefit, and the contrary of the benefit of the people it governs. But I find there are other countries in which they have changed their ideas on that subject altogether. Perhaps the time is come when we shall change our ideas upon that subject. When it gets to this point, that the good of the great mass of the people has become the ruling principle of government, then this repulsion to State interference appears to me likely to disappear. In certain nations with which I am personally familiar, they have obtained such confidence that the Government is only an organization for their benefit, that they no longer talk of government as government, they call it State service; they no longer consider Government as their rulers, but as their greatest benefactors; and they look upon the organization of the State as simply a mode of carrying out their interests in the best possible manner by a central organization which concentrates the whole energies of the State into doing good for the State. If you would, therefore, not say in future the Government organization and the Government interference, but if you were to talk of government as public service, then the whole of this beautiful plan of Colonel Strange's would at once come into existence. Because, if we say public service, the first question that will come is this, "Whom shall we have as our servants?" And if it is for the public service, you will next ask, "Shall we have for our servants the "people who know nothing about the thing we mean them to manage for us, or "people who know something?" Then, the answer will be, "We shall have people "who know something, if you please." Then will come the next question, "Ought "the State to have the best men for each subject, or ought it to have the second "best?" Then you would come to the conclusion that the State had better have the best men. And if you go on with this public service simply with the view to public good, and not to mere matters of personal power and class-aggrandisement, then you come out with this ideal system of Colonel Strange. You begin now to say, no man in the public service shall meddle with anything he does not under-

stand; and the man we look out for to be the public servant in any department shall be the best man the country affords. We will press him into our service, we will take possession of him, we will get his services somehow or other. If you do that, then at once this Commission recommended is appointed; then at once in every department of the State you get a fit man to do the work; and then, instead of doing things afterwards, and being clever after the battle, and being clever after the storm is over, and knowing all about it when it is too late, you will know all about it long before; you will have thought everything out; the best heads in the world will be at your service; you will keep your own secrets till the time comes; and then one fine morning the world will be astonished by knowing that you knew a great deal more than they ever gave you credit for.

Sir JOHN BOWRING, LL.D., F.R.S.: I should like to say a few words. I, like everybody else, cannot but have been greatly interested in the most suggestive and sensible paper which we have just heard. I think our scientific friends have somewhat exaggerated the amount of opposition which suggestions so reasonable will have to encounter. I have always found in this country that the power of public opinion, when that public opinion represents public intelligence and public interests, settles all controversies and conquers all resistance. The point has been very strongly put that this scientific question is not only a matter that regards a particular department of the Army or of the Navy, but that it extends over the whole social field, and that from the meanest to the mightiest, by the aberrations which are caused by a want of scientific knowledge, all classes are affected; that there is no man so poor who might not be benefited by the diffusion of scientific knowledge and the creation of scientific power; and that there is no one so opulent that he would not have his riches increased and his felicity augmented if we could bring into operation the influential action of such a machinery as our excellent lecturer has described. The value of all these discussions is that the question may reach that tribunal of public opinion which, as I said before, is omnipotent in this country. I cannot but believe that if the address which we have heard to-night could reach the ears of the millions of people who read our daily papers, and if those papers, instead of being delivered over to the most frivolous, though perhaps to some extent romantic and interesting stories, just the quarrels between this man and that woman,—if they could tell their readers that there are questions before them on which the well-being of the community depends, the reputation of the country, the influence which we hold, and which I believe we shall continue to hold: if it were pointed out most strongly to everybody, that after all this great question between France and Prussia has been decided by the bigger heads and the higher intelligence of the Prussians, I cannot but believe that our people would seek also to get amplitude of brains, and to introduce those qualities into our government which have led to such extraordinary results—results which few anticipated. There, again, we see knowledge penetrating deep among the masses. And when everybody interested in a particular department, engaged as a warrior, engaged as a sailor, is taught that science gives him appliances of great importance to his profession, of great value to his honour, which shall bring fame and reputation to him, when that state of things penetrates the community, depend upon it there will grow up an ambition, a desire for knowledge; and the desire for knowledge will create the possession of knowledge, to which alone in my judgment we may look with any confidence for the future, as we cannot but look with great regret on its deficiencies in the past and in the present.

Dr. MANN: It was my purpose to have said pretty much what has fallen from Sir John Bowring at this instant, and I am exceedingly glad that he has anticipated me, because he has said it so much better than I should have done. I have no doubt he has touched on what we have to look to as the real turning point in this matter. It is the point he has just alluded to as public opinion. The great difficulty we have to meet is simply that in matters of science there is no efficient public opinion. Take the best illustration that I can perhaps put before you—the position in which Government stands in relation to sanitary matters. There can be no question whatever that if you had a sound, well-developed, and well-extended scientific education, you would need no organization from the Government whatever in this particular department of science. If every man knew what his own organs

were, and what the management and care of his own body should be, you would want no sanitary organization of Government in towns. The necessity for interference on the part of what we call Government, comes simply out of the ignorance of the masses. So long as you have ignorant masses you must have some organized power to do for them what they in their ignorance cannot do for themselves. But it is not easy to form a strong public opinion by spreading abroad such papers as Colonel Strange has read to-night, simply because the mass of mankind cannot understand such papers. There is our real difficulty. You will find generally, and I return again to sanitary matters, that the man who under any circumstances will employ sensational empiricism in any form—I speak it not invidiously, but merely as a piece of specific philosophic observation—will certainly more easily get the ear and the confidence of the public, than the man who deals with his theme as a matter of pure science. The reason is that at the present time people do not understand pure and exact science. Therefore, I say, our main difficulty is that when we put a matter of this kind before the public, they will not see and know where their real interests lie. A sound public opinion in this matter must first of all be formed; and then there will certainly be ready and cordial acceptance for the great amelioration at which Colonel Strange aims. No Government of the day could possibly meddle with a question of this kind; without such sanction, no Government could think of a Science Council that will cost £75,000 a year, unless public opinion says, "You shall have this Council; it is for our good." We have first to see how in this matter we can get the public to understand what public interests require. The instant that is done, the whole thing will be in our hands. I do think that one of the greatest reasons we have to thank Colonel Strange for having brought this paper before us is, that no better step can at the present time be taken to form public opinion than that there should be such men able to say what they want, and what the good of the community requires, as Colonel Strange has said. I should scarcely have ventured to trespass upon the meeting with these few remarks, in confirmation and extension of Sir John Bowring's views, but for the fact that I have for a long time had the privilege of being in intimate communication with Colonel Strange, and so know thoroughly what his motives are in working as he is doing on this occasion.

Captain SCOTT, R.N.: The yearly cost of the Council proposed could be saved in the Navy alone. At the present time a very large improvement could be made in the power of the Navy, but as a Committee is at present considering this question, it would be premature for me to point out in detail how such improvement could be made. I have no hesitation, however, in saying that the power of our Navy, if its armament had been properly developed from the first, would have been double what it now is. As regards the position of Government with inventors, I think it is as great a misfortune to this country as to its inventors, that the Government should be enabled to take their property, and give them a remuneration fixed upon by their *employés*, instead of a remuneration fixed upon by independent persons. I think Government loses very considerably by this course; and I think it will hereafter lose much more, for inventions which might go to swell the national power, and to fill the coffers of this country, will hereafter be taken to those who will pay inventors fairly and honestly. At the present time there is no tribunal whatever before which the value of property in inventions can be assessed, much less is there any appeal from Government decision; and as a false economy is kept in view, instead of the value of an invention being fairly regarded, the great consideration seems to be how far the inventor's just reward can be cut down. I therefore fully concur in the proposals of Colonel Strange, who has gone so ably into the whole of this large question.

Mr. CORNISH: I should like to say a few words in praise of Colonel Strange's very masterly paper. It seems to me about the most important paper that I have ever heard read in this or in any other society. I am glad that Captain Scott spoke as an inventor. I quite concur in what he said, and I believe that for the want of such a scientific commission as Colonel Strange recommends, the Government loses yearly some scores of inventions, of great value to the country. As a journalist, I quite agree with Colonel Strange, that the press is unreliable. Colonel Strange, in his paper, spoke of the Committee on Small Arms. I think that time will show that the

rifle they have selected is not only unmechanical, but I do not think that it can ever be made in quantities. I think the principle which Colonel Strange has proposed for the selection of Scientific Committees is an excellent one. Under that system the jackdaw may make his appearance in such an assembly, but I think the peacocks would soon drive him out again. Colonel Strange dwelt upon the cost of the Committee. I think the sum he named, £1,500 for each member, is a very reasonable one. And I think it would be safe to put down £25,000 more to be spent in advancing science under the direction of that Committee. The cost might come out of the balance of the money that is now paid to Government by inventors.

Surgeon-Major F. J. MOVAT, M.D., F.R.C.S. : I did not come here prepared to make any remarks upon the admirable paper of Colonel Strange, but as one fact is worth any amount of argument in establishing the truth of the proposal that he has laid before you, I think I can mention a failure far greater in dimensions, far more costly in every way, and far more serious in its results even than the illustration which Colonel Strange has adduced of the "Captain." Most persons in this room are aware that for a long time a large amount of discussion took place as to the proper mode of husbanding the lives of the European soldiers in India, in which country my official life has been passed. After a considerable amount of discussion, after a Royal Commission had sat upon it for a great length of time, and after a vast body of evidence had been collected, it was determined that one of the chief defects was a want of proper barrack accommodation. Accordingly, a grand scheme of new barracks, costing from six to eight millions of money, which has plunged that country into financial discontent and deficit ever since, was sent out to the Government of India, was adopted by that Government, and was carried into effect. The whole thing is now proved to be one gigantic error, from beginning to end. The soldiers cannot live in them, and they do not die in them in less numbers than they died in the old barracks. Such a mistake could not possibly have occurred had a thoroughly scientific commission been in existence such as that which Colonel Strange has advocated. It is only for the purpose of placing before you what I consider to be an apt illustration of the truth which has been so ably and so excellently argued by Colonel Strange, that I venture now to address to you these few remarks.

Dr. WYLD : I must inflict upon you a very few remarks. I think every sensible man must agree with the lecturer, that science has not been sufficiently represented in this country, and that the Government has not been sufficiently under the influence of scientific men. But there may be a question as to how an alteration in that particular is to be brought about. Let us look for a moment to the constitution of the House of Commons. You have there the landed interest very broadly represented; you have the Church through its influence widely represented; you have the law very widely represented; and more than all, you have the commercial interest represented. But you scarcely at all have the scientific interest of the country represented. Recently, you have had members appointed from the Universities of Scotland under the new Act. A very excellent thing it has been. But could that principle not be carried out further? and, if it were, would not that be a solution of the difficulty? The people of this country have not been educated scientifically, and they take no interest in science. But as we are going to have a wider range of education, and as we are going to have compulsory education, and as that compulsory education is to embrace science from the very foundation of the population, I think that if we wait a certain number of years, we shall find that England is destined to become as distinguished in science as she has hitherto been in commerce. I look forward to that day; and then, I think, you will have Members returned to Parliament of a scientific turn of mind, more than you have at present. Instead of having men returned merely because they have large mills in certain districts, or large tracts of land, people will have such an admiration for education and pure men of science, that constituencies will naturally prefer these men to men whose only title to election is perhaps their wealth. Therefore, I think that gradually, and without a central committee of scientific men, you will have ultimately a scientific House of Commons. Well, if you have a scientific House of Commons, you will have scientific ministers and scientific heads of departments. And if you have scientific heads of departments, who of course have free intercourse with all the

science of the country if they so choose, you will then bring about the result which the lecturer has wished to show us is to be brought about in his particular way. I can see an objection to forming a central committee of science. In the manner indicated, it would be a sort of substitute for the House of Lords, a scientific House of Lords over-riding the ministry and the House of Commons. Whether it did so or not, there would be a feeling in the House of Commons that there would be that danger. Therefore I am still of opinion that the right way to solve this question will be in accordance with the genius of this country; namely, by slow growth, by growth of scientific knowledge and love of knowledge itself. We must not run away with the idea that scientific men are infallible. The case of the "Captain" has been brought forward several times to-night. But I question whether that is a manifestation of ignorance of science. As I understand it, science is previous knowledge. That vessel was built by one of the greatest shipbuilders in the world. If any man was able to build a vessel scientifically, it surely was that man. Notwithstanding which that ship turned head over heels, and drowned the unfortunate people on board. It is a melancholy thing; but I question whether a central committee of pure men of science would have prevented that catastrophe. Mr. Scott Russell, we all know, is a highly scientific man, and his late lamented friend, Mr. Brunel, was also one of the most highly scientific men in Europe. These two gentlemen designed and built the largest ship that ever floated; and that ship, though designed and built by scientific men, has been a failure.

MR. SCOTT RUSSELL: Commercially.

DR. WYLD: "A commercial failure." That is, a failure from ignorance, and therefore a practical and scientific failure. There we have an illustration that mere abstract science will not prevent you from falling into grievous practical errors. At all events, I think we may at least congratulate ourselves in the meantime that although we are a very unscientific people, of course, we seem yet to have an enormous amount of common sense in the British mind; and I think with all our defects, and with all our want of science, and with all our blundering, the British nation at the present moment is the best governed nation on the face of the earth, and I think I am not wrong in saying that we have the finest ships, the finest guns, and the finest rifles in the world.

MR. MERRIFIELD: I propose to trouble you with very few observations indeed on the subject of Colonel Strange's paper, because I feel it would be unbecoming in me, at so short a notice, to attempt to pronounce any judgment, even if my opinion carried any weight, on such a large and important subject. There is one point, however, on which—supposing any Council of the sort proposed, whether the one which is suggested or any other, temporary or permanent, to be appointed—I would go beyond what Colonel Strange suggests. In that observation I refer to the particular class of cases in which the Government, in their own manufactures, use the inventions of other people, and settle what they shall pay for them. I need hardly repeat to you how very unsatisfactory the present state of things is, in which Government or their Officers are themselves both judges and parties in the same cause. In such a case as I allude to, if the question of the value of the invention, and the remuneration to be given for it, is to be referred by the Government to any Committee, I hold most strongly that the Government ought to be bound, without any other appeal than that to a superior Court of Law, by the judgment and the financial award of that Committee. If they come before that Committee, whether it is to be their own or an independent Committee, even if it were the arbitration of a foreign nation, they have no right to reserve to themselves an appeal from the judge that they have chosen.

With regard to the general question, as to whether it can be done in this way or in that way, I think it is quite certain that we shall have to educate the nation very considerably before we can get this scheme carried, or anything equivalent to it. I am glad to see Colonel Strange taking so important a step in the education of the country as he has done. There is another point to which it is necessary to direct public attention, and that is the haphazard character of the awards now made without any rule, without any scientific knowledge to guide them. A good many years ago, before I took charge of the School of Naval Architecture, I was engaged in the Education Depart-

ment in directing payment of various grants, from £300 or £400, or more, to £30 or £40 at a time, and I invariably found, where the grants were not settled by any fixed rule, but were awarded by what the case was thought to deserve, that those grants never gave a feeling of security to the Officers making them, and they seldom gave any satisfaction to the recipients. I think, therefore, that in respect of patents, or of any inventions which Government is to take any profit from, we must have some specific method of awarding the compensation by some independent authorities who have no interest whatever in the matter, and, consequently, whose decision would be unimpeachable; and when the party through whom the money is to be paid makes the award, the award must depend upon fixed rules, so that he may have no influence and no personal voice in the judgment to be given. I feel that I can bring forward a great many examples in support of what has been alleged as to the effect of chaos and the want of science in the present day—the want of a proper tribunal of science; but I will only mention one. I suppose it will be conceded that we have plenty of architectural skill in the nation, and that we are generally believed to have made great advances in architecture lately. Now I do not know any modern public office in which the clerks are comfortably housed. The greater part of the buildings smoke, and many of the clerks are put in dark rooms. Altogether I should think a very large sum of money was lost by actually invalidating clerks, or compelling them to be idle when they ought to be at work, in consequence of the unfitness and ignorant design of the public offices.

Colonel ALCOCK: As it is getting very late, I will not occupy you more than a few minutes. In the course of the discussion the subject of inventors, sanitary matters, and other subjects have been introduced, and I understand the principle of Colonel Strange's plan to be that the scientific subjects which were so well discussed, and which have so much light thrown upon them by the different scientific societies, should, in point of fact, be centralized by a permanent Commission. That tempts me to allude to our own as one of these societies, and one in which inventors receive every encouragement, and for whom, by the opportunity afforded to them of explaining their views, considerable publicity is obtained. I may say that some of the other subjects have been advantageously brought forward here. For some time—I may say for years—we have been discussing the advantages of scientific improvements in implements of war, and seven months of carnage have rendered us familiar with their effect. The horrors of that war have been mitigated to a certain extent by the aid afforded to the sick and wounded, and it was at this Institution, and before the Geneva Convention was signed, that that subject was introduced by a lecture in this room. It may likewise be in the recollection of some of the members of this Institution that six or seven years ago Dr. Domenichetti brought forward his views that greater attention to the sanitary laws would be required, and that by employing medical Officers of the Army and Navy benefit would be conferred upon both those services in giving promotion, and likewise to the public generally, in the better attention to sanitary laws. If this meant centralization, as I imagine that it did, there cannot be a stronger or better proof of the advantage of that Officer's plan, than that quite recently, as I believe, at the Social Science Association, a paper has been read and the subject has been discussed of the necessity for such a centralization, in order that, instead of leaving the Health Officer under parish authorities, to bring him under a central authority. I should be taking up the time, and the Chairman would think I was going off the main subject, if I were to pursue these remarks, therefore I will only say that the paper we have heard read is very comprehensive, and introduces both physical and moral subjects, in the widest sense in the physical. We often hear of the expansive nature of a new agent, and if this valuable lecture, and the discussion to which it has given rise, including the excellent speeches it has called forth, should produce any effect, it will show that there is likewise an expansive and impulsive power in a new idea.

Major PALLISER, C.B.: I did not intend to take up your time at this late hour by making any remarks; but I feel rather called upon to say something with regard to the last speaker but two, who brought forward the "Great Eastern" as an instance of the failure of scientific men, and who also said that a scientific council like that shadowed forth by our lecturer this night, could not have prevented the loss of the

"Captain." It may be perfectly true that the "Great Eastern" has been a failure as a commercial speculation. Yet she can hardly be said to be a failure as an engineering feat, and as the production of a scientific mind. But for the "Great Eastern," could the heavy Atlantic cable have been laid; but for the "Great Eastern," could we have sent out at a moment's notice several regiments on board one ship at a time, when we were afraid of a sudden attack upon Canada? With regard to the loss of the "Captain," I think the lecturer said that it was due either in the first place to the plan not being thoroughly investigated; or, in the second place, to its not being thoroughly objected to; or in the third to the advice not being regarded. While cordially agreeing with Colonel Strange in all the carefully thought out arguments which he has advanced this evening, I wish to make a remark upon the second reason he suggested, viz., the plan not being objected to. It was objected to, but *it was not objected to on scientific grounds*. There was no specific scientific reason given to the people in authority on account of which the "Captain" should not have been sent to sea. The objections were of a vague and general nature. The reason why the "Captain" was lost was because she capsized, and that was the only thing the Admiralty were *not* told she would do. Had there been a scientific commission like this in existence, the Admiralty would probably have been told after a scientific investigation of the subject, that the "Captain" was in a state of unstable equilibrium, and not fit on *that* account to go to sea. No Government would have ventured to disregard independent scientific advice based upon specific and distinct hydrostatical and mathematical data, and the result would have been that the ship would not have been allowed to go to sea in the condition she was in, and consequently the "Captain" would *not* have been lost.

MR. STANLEY: I should like to say a word or two. I will not detain you many minutes. I am a manufacturer of scientific instruments for the Government; in that position, I think a word or two may be of advantage. I can say this confidently, manufacturing for the military part of the Government particularly, that they have the most unscientific instruments of any individuals in the country. I manufacture for a great number of engineers and other scientific people; and I manufacture no obsolete instruments, except for the Government. I do not manufacture an imperfect instrument for India, nor yet an obsolete instrument. I ought to make that exception. But for the military at Woolwich, I have been sending a certain class of instruments, and I have had them rejected with such remarks that no one but such unscientific people could possibly make. I can assure you that I have sent in goods to Woolwich that never can be used in this age for the purposes that they are supplied. I really think I could point to instruments made from patterns that are fully a hundred years old, and made by people who were a hundred years behind their time when the patterns were made.

Colonel STRANGE: My paper itself occupied so great a space of time, that I should be taking a liberty if I were now to occupy any more time. Nor is it necessary to do so, because, in point of fact, as far as I have been able to judge, the meeting is at one with me. By that I do not mean to say that every individual in this meeting agrees with me in every opinion I have expressed. Nor do I suppose that every person here who might wish to see my recommendations adopted is as sanguine as I am that they will be adopted, or as sanguine as I am supposed to be, that they will be adopted. My excellent friend, Mr. Scott Russell, who entertained us with so able a speech, and I, have discussed this and similar questions at great length together. If I may take the liberty of saying so, I think I know Mr. Scott Russell's mind on this question. I know Mr. Russell agrees with me entirely, that there should be a change of this sort. He has encountered more than I have the unwillingness and the inability of the Government to grapple with scientific questions. He has had, perhaps, far greater experience than I have had of that kind; and I can perfectly understand his almost hopelessness at a scheme like this being soon entertained. But Mr. Russell's experience, although so recent, is still of the past. We are in different times now; the times are not the same now that they were ten years ago. Eight years ago I began to think on this subject. I never met anybody, with one or two notable exceptions, whom I could get to interest themselves at all in these subjects

—one of these persons was that most eminent man, Sir William Thomson, Mr. Scott Russell is another. There were very few men eight years ago who would talk to you five minutes on the subject we have been discussing this evening. Less than three years ago I took the liberty of opening up the subject in a paper I read at the British Association, in which I maintained that the Government ought to do more for science than it was doing. There was not a single speaker in the discussion on that paper who did not oppose me. The result has been that a Royal Commission has been appointed to do what I said should be done, that is within the last three years. That encourages me to think that we may be going a little faster in these matters than we used to do; and having in me to say and to feel as I do, I could not rest silent without speaking as I have done. A gentleman in the theatre has made the only remarks that I think I may consider as opposed to my views. I am not sure that even he would not be glad to see organization. (Dr. WYLD: Oh, yes.) I think he would. But he is more devoid of hope than Mr. Scott Russell. He tells us that we have now compulsory, or next to compulsory education; and that in that education is to be included science; that then we shall have growing up among us some very scientific children, who in process of time will grow into scientific men, and those scientific men will, eventually, turn into scientific Members of Parliament, out of whom we shall extract, at last, scientific ministers. I say if we are to wait till then, if we are to wait for that consummation, the case is indeed utterly hopeless. Mr. Scott Russell will check me if I am wrong in the statement, which I have taken from his published work, a most valuable work, on technical education. In that work he tells us distinctly that at this moment we are one generation behind Germany in science. (Mr. SCOTT RUSSELL: In scientific education.) And the gentleman on the bench behind him (Dr. WYLD) says you must wait two more generations. It will, therefore, take three generations to make a scientific minister; that is 75 years, equal to those which Germany now possesses; and for 75 years we are to go on "happy-go-lucky." The Germans will not go on in that way; nations over the water will not go on in that way; and they may take a fancy to give us a lesson in some rough manner. I say if we are to sit still and wait for the hope of a scientific House of Commons, which is the most chimerical hope that ever entered the head of man, we must wait for ever. The present is as good an opportunity for mooted these questions and forcing them on public opinion, as ever took place. We have had our attention drawn to the imperfections of our Navy. We have had our attention drawn, and very forcibly by yourself, Mr. Chairman, to the state of the Army, and to the questions relating to its employment in time of warfare. There is a Bill before Parliament for the re-organization of our Army. Those two questions alone involve science at every step; and the minister who will undertake to organize the British Army without scientific advice is, I think, the next thing to a madman. That is what I think. The opportunity, I think, is a good one. The example we have from Prussia ought surely to enforce upon us the duty of acting. I intended to say something about the "Great Eastern," but Colonel Palliser has anticipated me. It was a commercial error. The ship is a fine ship, built on scientific principles; and it is a scientific success. Therefore, its failure as a commercial speculation does not bear the least on the question.

The CHAIRMAN: I am sure that we are much indebted to Colonel Strange for the able paper with which he has favoured us. At this late period of the evening, I will only trouble you with very few observations. As Mr. Scott Russell has observed, we are not an organizing nation; and we were told the other day, by the head of the Opposition, that this country is not governed by logic. This is, perhaps, especially to be observed in reference to scientific subjects. On certain points, I think Colonel Strange does not give quite sufficient credit to existing machinery for arriving at conclusions on some scientific questions; he may not, perhaps, be aware of the existence of such machinery. At the same time, no central body exists to whom questions of general science can be referred. And I believe it is the sense of this meeting that it is most desirable that in some shape or other such a body should exist. The composition of that body is a matter that would require great consideration. If I may venture an ob-

servation before one who has, like Colonel Strange, considered the matter so much more deeply than I have ever done, I should say the Council he proposes would be a great deal too large; and I feel quite sure that if the proposal were presented to the Chancellor of the Exchequer to have a body of fifty counsellors, each with a salary of £1,500 per annum, we should put the case in rather a hopeless position. At the same time, I do not think that this observation at all strikes at the vital question, viz., the advisability of having, in some shape, such a Council as Colonel Strange proposes. Possibly we might commence with a Council consisting of a few men of abstract science, men capable of dealing generally with scientific questions set before them; and for any special business that they might have to deal with on any particular occasion, members specially qualified might be added, either from the Government service or otherwise, as the case might be. Until that day arrives, which was shadowed forth by one of the speakers this evening, when we shall have a Parliament of science and a scientifically educated community, I think some such organization as that proposed would be a great benefit, not only to the public service, but to the general community, and to the State at large. As far as the particular branch of the public service with which I am connected is concerned, I myself proposed in evidence that I gave before a Committee with reference to the organization of the War Office, that there should be such a Council to deal with some naval and military questions; that that Council should consist of the highest naval and military authorities that could be selected, combined with political men, but not in great numbers; who should consider and report to the Government upon questions of defence and questions relating to war. In many questions relating to the defence of the country, there is much confusion in the public mind. As I observed the other night in a lecture to which Colonel Strange did me the honour to refer, there seems to be very little conception as to where naval defence ends, where military defence begins, and where both naval and military defence should be combined. In many such questions, involving the consideration of scientific principles, a council would be a great aid. I am sure you will all join in thanking Colonel Strange heartily for his very valuable lecture.

LECTURE.

Friday, May 19th, 1871.

GENERAL SIR EDWARD SABINE, K.C.B., R.A., President of the Royal Society, in the Chair.

THE WINDS OF THE NORTH ATLANTIC.

By Captain HENRY TOYNBEE, F.R.A.S., of the Meteorological Office.

It may be well to commence by saying a few words on the state of the barometer, which accompanies all winds in these latitudes. Then, after dealing with our special subject, I propose concluding with some remarks on certain theories as to the cause of wind, and their bearing on our prevailing winds and climate.

Buy's Ballot's Law.—By a number of simultaneous observations of the wind and barometer at various stations in Europe, Buys Ballot has found that the difference of barometer readings, ranges in a line nearly at right angles to the wind, so that, by turning the back to any wind, there will be a lower pressure to the left than to the right hand.*

By this means we know that—

With the wind *North*, the pressure is lower in the East than in the West.

”	<i>East,</i>	”	”	South	”	North.
”	<i>South,</i>	”	”	West	”	East.
”	<i>West,</i>	”	”	North	”	South.

and so on for all intermediate points, for instance

With the wind S.W., the pressure is lower in the N.W., than in the S.E.

Force of Wind.—Again, it has been found that the force of wind depends on the amount of difference in the barometer readings over a given distance, which is called the barometrical gradient.†

* In this lecture the word pressure alludes to the *barometer* only, and never to the *force* of the wind.

† This term was first applied to the barometer by J. Stevenson, Esq., C.E., F.R.S.E., &c.

Hence you perceive that the direction of our winds is related to the direction of the line which joins our highest and lowest barometers, being nearly at right angles to this line; whilst their force is related to the amount of difference between the readings of barometers placed at a certain distance from each other on that line.

Gradient.—DIAGRAM 1.

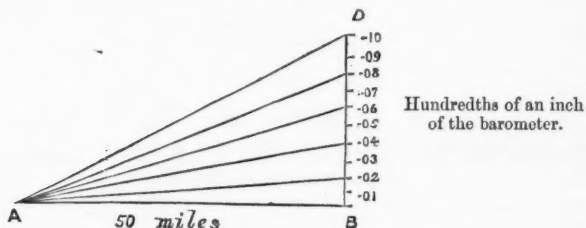


Diagram 1, taken from the barometer manual published by the Meteorological Office, will explain this.—

Line *AB* represents 50 geographical miles, and *BD* has ten divisions to represent hundredths of an inch of the barometer. The various lines drawn at increasing angles show the amount of barometer difference or gradient in that range. A difference of five hundredths to 50 miles accompanies a fresh breeze, whilst a heavy gale has been known to have a gradient of two- or it is believed sometimes three-tenths of an inch to 50 miles.

I will endeavour to illustrate my meaning. Suppose a ship at *A* to be at the centre of a hurricane, with her barometer down to 28·50, and another at *B*, with her barometer at 28·60, there would be a gradient of a tenth of an inch to 50 miles between them, and it would blow very hard. But suppose the ship at *B* had the barometer 28·70 instead of 28·60, the gradient would then be two-tenths to 50 miles, and it would blow very much harder.

Again, if this gradient continued all round *A*, we have good reason to suppose that the hurricane would rage with equal force from all points of the compass round the circle.

It is also found that there will be no wind if there be no barometer difference over a given space, be the barometer high or low: this accounts for the calm at the centre of a hurricane where the pressure is extremely low, but uniform for a certain distance, then rising steeply on all sides. As also for the calms of Cancer, or horse latitudes, where the pressure is very high but uniform.

These facts show that the barometer being low is not a positive proof that it is going to blow hard. Still it is found that generally the steepest gradients do accompany the lowest pressures, hence a falling barometer is a useful warning.

As Buys Ballot's law is very important, at the risk of repetition I will again say that with the back to any wind blowing in these latitudes

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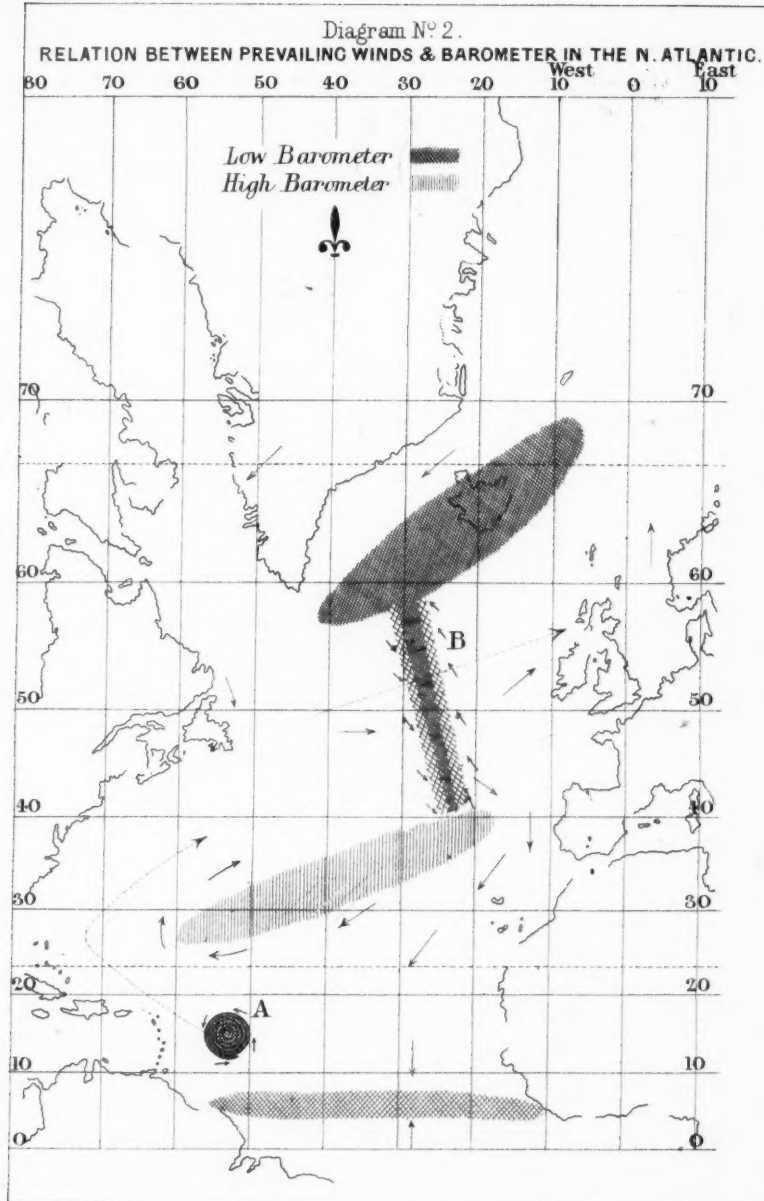
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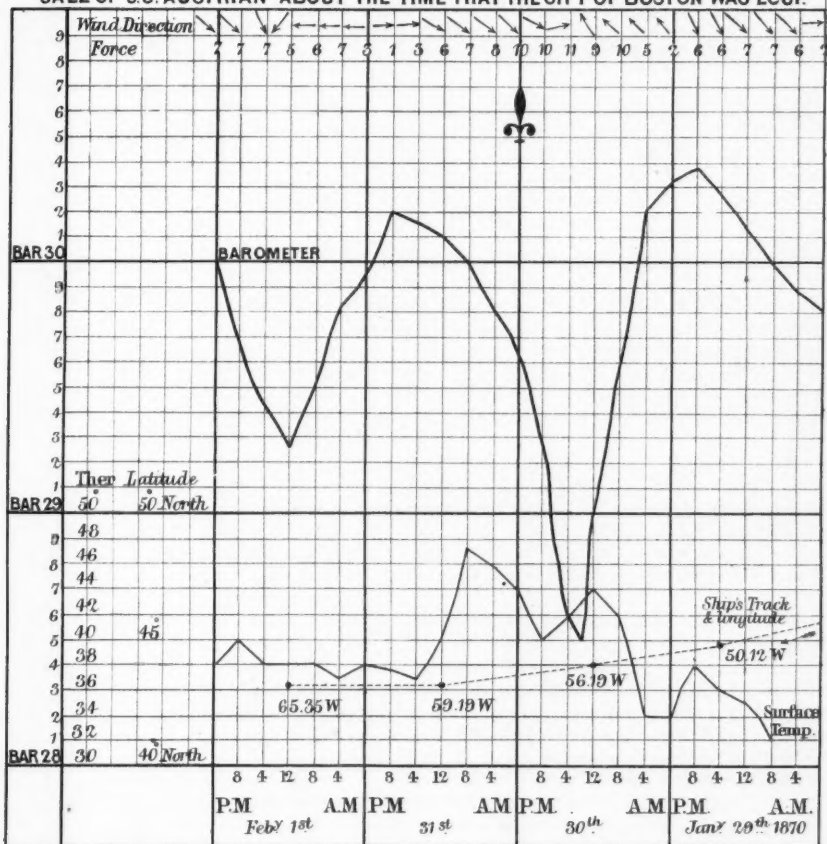
BAR 3

BAR 2

BAR 2

Diagram N° 5.

GALE OF S.S. "AUSTRIAN" ABOUT THE TIME THAT THE "CITY OF BOSTON" WAS LOST.



there will be lower barometers at all places to your left, and higher at all places to your right, whilst the strength of that wind will be related to the amount which the barometers differ in a given distance.

Relation of Wind to Pressure.—Now it is clear that after learning this relation between our winds and the barometer, if one be given the other can be determined. And not only so, but if the direction and force of a prevailing wind be known, the direction and amount of prevailing barometer difference will be indicated.

A careful collection of observations from various sources proves that the *prevailing* winds of the North Atlantic are related to certain *prevailing* areas of high and low barometer, which exist in that ocean, and are represented on diagram 2.* The areas are not so well defined in nature as the shading on the chart indicates, neither is it to be supposed that the pressure is uniform within them, but merely that in their neighbourhood it is higher or lower than that which surrounds them.

The exceptional winds of the North Atlantic, viz., West India hurricanes and ordinary gales of higher latitudes have also their respective areas of low pressure which travel with them, and by their shape, as well as position with regard to the more permanent areas of high and low pressure, modify the direction and force of their winds. An attempt has been made to represent these areas by patches A and B on diagram 2.

Prevailing Winds, and Prevailing Pressures.—Let us test these statements by first considering our *prevailing* winds, beginning with the S.W. winds of these islands in winter: they ought to be accompanied by a *prevailing* low pressure to the N.W. of England.

Diagram 2.—Now, by referring to diagram 2 on which I have represented prevailing areas of low pressure by dark and that of high pressure by light shading, it will be found that the mean of a large number of observations gives a low pressure in the neighbourhood of Iceland, especially in winter.

Then again it is found that much N.W. wind prevails on the American side of the Atlantic in winter, which, according to the law already stated, requires that there should be a low pressure to its N.E., and that this does exist, is shown by diagram 2.

A similar record of observations, shows that Norway gets much S. and S.E. wind, whilst Greenland gets much N.E. wind in winter, and it will be perceived that they respectively have an area of low pressure to the S.W. and S.E. of them.

Wind and Pressure off the Coast of Portugal.—Again, with the prevailing Northerly wind on the Coast of Portugal, said by seamen to blow for nine or ten months in the year, it should be accompanied by an area of higher pressure to the West; and such an area is found to exist over the sea to the west of Portugal.

This Northerly wind is found to be much more constant in summer than in winter, and a careful record of the barometer shows that the area of high pressure, which always exists at the Northern verge of

* The data for this diagram are from "Buchan's Isobaric Curves," Transactions of the Royal Society of Edinburgh, the "Admiralty Wind Charts," and "Observations in the Meteorological Office."

the N.E. trades, lies much further North in summer, carrying with it the Northerly wind, which prevails on its Eastern edge.

Wind round "Horse Latitudes."—We will now consider the experience of a homeward bound ship. As she approaches the Northern verge of the N.E. trades in about 30° N. and 40° W., the trades gradually draw to East, with a fast rising barometer: this East wind indicates a higher pressure to the North, which is experienced as the ship proceeds, until it frequently happens that at last the barometer ceases to rise and the wind to blow, leaving the ship becalmed in the celebrated "Horse latitudes," which lie within the lightly-shaded patch, where the barometer is very high, but uniform, and out of which a sailing ship cannot escape until she creeps to a part where the pressure begins to decrease, then the wind will probably go to S. and S.W.

Again, in the logs of vessels bound to the West Indies, we frequently find the following entry:—"Here we are again with a S.E. wind, where the N.E. trade ought to blow." Then, again, vessels from America find it difficult to make any easting in the so-called N.E. trades, proving that they very frequently get the wind S. of E.

It is also found that homeward bound ships, which escape the calms at the Northern verge of the N.E. trades, generally have the wind change from N.E. to S.E., S. and S.W.; now, by Buys Ballot's law, with the wind S.E., there must be a higher barometer to the N.E.; so here, again, we have proofs of the winds drawing round this area of high pressure.

Equatorial Doldrums.—Once more, the ship from England bound across the equator, finds the wind to draw more Northerly as she approaches the Southern verge of the N.E. trades, whilst, after passing through the equatorial calms, the S.E. trades commence at South. It is also found that as this zone of doldrums is approached, the barometer falls; hence the position of these doldrums, for a certain season of the year, is represented by this darkly-shaded belt. I say for a certain season because the zone of equatorial doldrums travels from the Equator to 10° or 12° North and back during the year.

Into this zone the air seems to blow from North and South, whilst the pressure still remains lower than on either side: we have, therefore, reason to suppose that here, on the border line of two hemispheres, the air is drawn directly towards the lowest pressure. It will be remembered that, at a certain distance from the equator in the northern hemisphere, the air draws round an area of low pressure, keeping the lowest pressure to its left, whilst at a certain distance from the equator in the southern hemisphere, this order is reversed, and the lowest pressure is to the right of a person standing with his back to the wind. Hence it is reasonable to expect that the air will move directly for the area of lowest pressure in a part where the two hemispheres meet.

We have now treated of the more permanent areas of high and low pressure in the North Atlantic, and the large arrows in their neighbourhood point out the prevailing directions of the wind. Here let me add that similar areas of high and low pressure are found to exist in the other great oceans. (See the Barometer Manual published by the

Meteorological Office.) If these areas were quite fixed and the only disturbances to which the air of the North Atlantic was subjected, the direction and force of the wind might be expected to be equally fixed. But, besides the above, local and temporary disturbances are very common.

West India Hurricanes.—In the first place there are the hurricanes of the West Indies. At present be it remembered we are not considering the *cause* of wind, but the *facts* which accompany it. These hurricanes have been too well explained to need further remark, and are only alluded to in order to point out a difference which exists between them and the gales of higher latitudes.

Darkly-Shaded Patch A.—The darkly-shaded patch *A* on diagram 2 represents a circular depression of the barometer, which accompanies a hurricane. It is well known that they usually originate to the eastward of the West India Islands, but not so far E. as 30° W., for ships which cross the Equator on their way to and from Europe, seldom experience them. It will be remembered that wind does not blow unless there is a difference of barometer readings over a given distance, so that if the area of low pressure which is formed with, and accompanies a hurricane, did not find itself surrounded by a much higher pressure on *all* sides, the wind would not blow hard all round it. Looking at that part of the sea where these hurricanes are originated (say 15° N. and 50° W.), it will be seen that an area of high pressure exists to the north of them, so that on that side there will be a steep gradient, and strong Easterly winds may be expected. There is also a steep gradient on all sides, which causes the circular motion of the wind; but I have specially alluded to the gradient for their Easterly wind, because so many of the gales in higher latitudes seem to have no East wind, beginning as they do at South, and ending at W.N.W. and N.W.

Gales of High Latitudes.—The gales of high latitudes are, however, accompanied by areas of low pressure, which frequently travel to the Eastward; this will be shown by and by. On referring to diagram 2, it will be seen that they travel over a part of the sea which is bounded on the North by an area of low pressure, and on the South by an area of high pressure; hence we should conclude theoretically that there would be a very steep gradient on their southern sides, and little or none on their northern.

Now a steep gradient on the South side of an area of low pressure in the Northern hemisphere, is accompanied by strong Westerly winds, whilst there being little or no gradient on its Northern side, implies that there will be little or no Easterly wind. Another peculiarity in these gales is that they seem to extend over several degrees of latitude, giving the same changes of wind, viz., from S. to S.W., W. and N.W., to ships many degrees apart.

Darkly-Shaded Strip B.—The darkly-shaded strip on diagram 2, marked *B*, represents the state of the barometer, which, according to Buys Ballot's law, must accompany one of these gales, supposing that it were blowing at the same time over the whole space where the strip is placed. The length, breadth, and position of this strip are conjectural, but if our gales extend over several degrees of latitude, and

By's Ballot's law be true, some such wave-like depression of the barometer must accompany them.

The shading of this wave is intended to show that the barometer gets lower as you pass from its southern to its northern end, also that it is lower along its centre line than on either side. Now if you keep By's Ballot's law in mind, you will see that to any number of ships placed along the eastern edge of such a wave the wind will be Southerly, and as the wave sweeps over them to the N.E., all will have falling barometers, until the wind changes to S.W., when all will have rising barometers, as the wind veers to N.W. It will also be seen that the most northern ship will have the lowest barometer, but not necessarily the strongest wind, for the force of the gale depends upon the gradient, which might be steepest at the southern end of the wave, where the barometer is comparatively high. Every seaman will allow that this represents the action of the barometer and changes of the wind in very many of our gales. Similar waves seem to be common in high southern latitudes, causing the wind to change from N. to N.W. and W.

* *Direction Line of Wave affects direction of Wind.*—It will be seen that the direction of the wind accompanying such a wave of low pressure, would be modified by the line of its direction; for instance, if it points N. and S., the gale will begin at S. or S.S.W., and end at N.N.W. or N. But if it points N.W. and S.E., the gale will begin at S.E. to S., and end at W. to W.N.W. This latter kind of gale is not uncommon, indicating some such direction for its wave of low pressure.

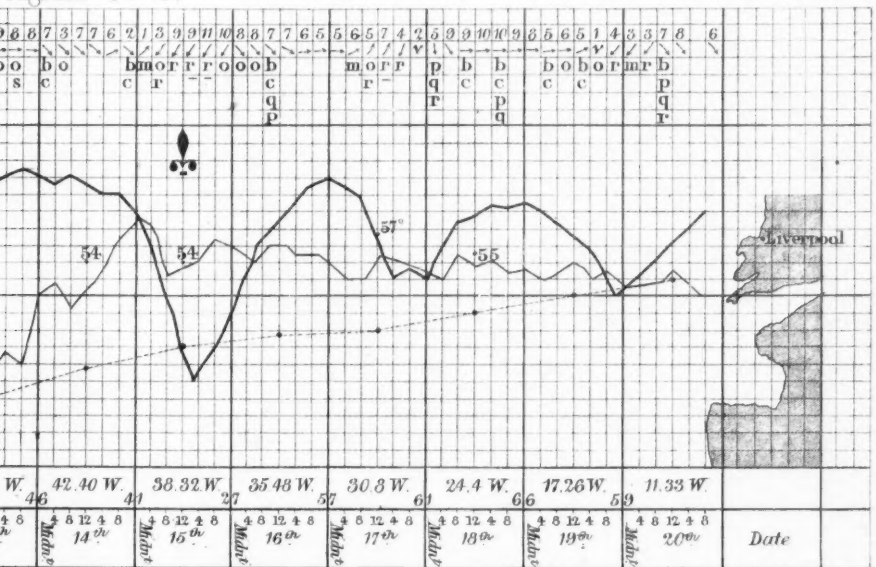
Diagram 3.—Diagram 3 gives the curve of the barometer and surface temperature of the sea, also the direction and force of wind, and the weather experienced by a steamer crossing the Atlantic from E. to W. It will be seen that her barometer curve represents sections as it were of several atmospheric waves; but such sections cannot show their increasing depression to the N., which must exist to keep up a Westerly wind over several degrees of latitude. The changes of wind from S. to W. and N.W., are very clearly seen to accompany each section.

On carefully examining this diagram, it will be seen that the steamer going to the Westward, got the changes of wind and variations of pressure in the same order as they are generally experienced in England, only quicker. For instance, with a falling barometer it was S., shifting to S.W., whilst with a rising barometer it was W., shifting to W.N.W. or N.W.

Diagram 4.—But by referring to diagram 4, which gives similar data for a steamer bound from America to England, it will be seen that the steamer steering to the Eastward had the wind and barometer steady for some days, when at last it fell rapidly with a *Northerly* wind, whilst in three other passages to the Eastward, it rose rapidly with a *Southerly* wind. The commanders of some of the steamers which cross the Atlantic, now draw similar diagrams for each of their passages, and they fully bear out these facts. Here let me mention Captains Watson and Martyn, of Cunard's line; Captain Brooks, of Inman's line; Captain W. H. Smith, R.N.R., of Allan's line; and Captain Kennedy, of the Oceanic line, as special labourers in this work. Captain Trautmann, of the German steamer "Westphalia," has also

"N" CAPTAIN J. A. MARTYN, OUTWARD BOUND TO NEW YORK.

Wind.



" CAPTAIN J.A.MARTYN, HOMEWARD BOUND TO LIVERPOOL

J. Jobbins.

sent in a very neat diagram. A log lately come in from Captain Watson of the R.M.S. "Palmyra," shows that he accompanied a high and steady barometer with a moderate Southerly wind, nearly the whole way from America to England. (I beg to hand round his very neat diagrams of several passages.) The difference in the number of changes in the barometer curves of outward and homeward passages is so great that they generally show at a glance which way the steamer was going. It thereby seems proved that many changes of weather cross the Atlantic from W. to E., otherwise the homeward-bound steamer would have as many changes of weather as the outward-bounder.

Steamers sometimes beat them.—Then again the fact that the homeward-bound steamers frequently cross the Atlantic quicker than these changes of weather is shown by their so often reversing the order in which the barometer acts with a given wind at a land station, or on board a steamer going west. For instance, in the case of a steamer bound W., the barometer falls with a S. and rises with a W. or N.W. wind; whilst with a steamer bound E., the barometer frequently falls with a North-westerly and rises with a S. wind. This shows that the steamer to America first meets the eastern side of an area of low pressure and passes out at its western, whilst the steamer from America first comes upon its western side and passes out at its eastern. It is true that this state of things would exist if the areas of low pressure accompanying our gales stood still, but in that case the homeward bound steamer would get as many changes as the outward-bounder, and would only reverse the action of the barometer with a certain wind.

It seems then fairly proved that the waves of low pressure which accompany our ordinary gales frequently move over the Atlantic from W. to E., and also that it is very common for a steamer to travel to the eastward faster than they do.

Do not mistake my meaning. I do not say that the ship bound to the eastward travels faster than the wind, which often goes 60 miles an hour, but that the wind is the internal action of a wave of low pressure, which may be travelling only 10 or 12 miles an hour, and the ship may go faster, cutting through the wave. A hurricane, for instance, may sometimes stand still, blowing furiously at the same time.

Land Observations also show motion from East to West.—I may add that this tendency in the areas of low pressures to move to the E. and N.E., is clearly shown by numbers of the curves recorded by self-registering instruments at the various observatories established by the Committee of the Royal Society, who manage the Meteorological Office, and given in the Quarterly Weather Report, published by that Office; there it will be seen that Valencia very frequently gets a change before Armagh, Armagh before Glasgow, and Glasgow before Aberdeen.

Effect of a Ship's Tack on the Barometer.—Perhaps I ought not to leave this subject without alluding to the effect of a ship's tack on the action of her barometer.

During a strong Westerly gale in the English Channel, the barometers on the French coast are from two to three-tenths higher than those on the English: it is clear, then, that a vessel going from England to France

is very likely to have a rising barometer, whilst another bound from France to England will have it falling, just as the outward bound steamer to America has a falling barometer with a Southerly wind, whilst the homeward bounder will have it rising.

This law being true with all winds makes it necessary that the captain of a ship under steam or sail, should consider the tack he is on and the speed of his ship, when consulting the rise or fall of his barometer.

With a rising barometer when on the starboard tack, he should look for other signs before expecting finer weather, especially if he is moving fast; whilst if it rises when on the port tack, he may place more confidence in it.

If it falls when on the port tack, and moving fast, he must remember that part of its fall is probably due to the fact that he is steering towards a lower pressure; whilst if it falls on the starboard tack, he must not forget that it is doing so in spite of his sailing towards a higher pressure.

It must be remembered that this order of tacks will be reversed in similar latitudes in the southern hemisphere.

Where Waves are Generated.—We have still much to learn as to where these waves of low pressure are generated. At the request of the Committee of the Royal Society, who manage the Meteorological Office, I am engaged on examining meteorological data of that part of the sea which lies between England and North America, collected during the end of January and beginning of February, 1870. It will be remembered that this was about the time when the "City of Boston" was missing. Various reports of great atmospheric disturbances came into the office, and it was thought that some light might be thrown on the winds and weather of the North Atlantic if the data for a few days were collected and thoroughly discussed.

In doing this I came upon a very deep area, or wave of low pressure, which prevailed to the S.W. of Halifax on the morning of January 30th. During that day it seems to have swept over several ships which were then to the eastward of it, at the rate of from 30 to 40 miles an hour, carrying with it a gale of hurricane force, which changed with all the ships from S.E. to S., S.W. and W., showing that a lower pressure passed to the North of each of them than that which they experienced, otherwise the wind would have changed from E. to N.E. and N.W., as it will be seen by diagram 5, it did do in the next depression, which passed over the "Austrian."

Diagram 5 has been copied from the log of the "Austrian," Captain Wylie, from Liverpool, bound to Portland, in Maine. It shows that her barometer fell an inch and seven-tenths in ten hours, and that at 2 p.m., when it was at its lowest, the wind shifted from blowing nearly a hurricane from S.E. to blowing harder still from W. The following extract from the "Austrian's" log will give some idea of its force:—

"January 30th, 1870, 8 a.m.—Blowing a heavy gale from E.S.E.,
"with furious squalls and a high confused sea; ship labouring and
"rolling excessively, and shipping much heavy water with great
"force over all.

- " 10:30 a.m.—Wind falling light.
 " 11:30 a.m.—Wind freshening from S.S.E.
 " Noon.—Latitude, $44^{\circ} 1' N.$; Longitude, $56^{\circ} 9' W.$
 " 1 p.m.—Blowing a furious gale from S.S.W., with terrific squalls;
 " a tremendous sea rising.
 " 2 p.m.—Blowing a hurricane. Wind gradually veering to the
 " Westward and more Westerly during the squalls. Taking much
 " heavy water on board. Barometer at its lowest, 28.50.
 " 4 p.m.—Wind W. by S. and blowing a perfect hurricane, with
 " furious squalls; spoon drift flying like smoke along the surface, and
 " the sea running in liquid mountains.
 " 8 p.m.—Heavy gale from W.N.W., inclining to moderate."
 From this time the wind moderated, still blowing from W.N.W.
 The "Austrian" was bound to the westward, and steamed easy
 against the worst part of the gale.

H.M.S. "Orontes," bound to the eastward, experienced the same gale but did not get the worst of it, and her barometer only fell to 29.30. Still her Navigating Lieutenant, Mr. Vine, told me that they had to heave-to, and he thinks it would have been very unsafe to have run before such a gale.

So far as I can estimate its position, the worst part of this gale must have passed over the "City of Boston's" track, so that it is hardly possible for her to have escaped either its South-easterly or Westerly winds in their greatest strength. I have heard from one of the ablest Commanders in the same line that he thinks she was running before this gale and came suddenly upon heavy field-ice, which would most likely have caused her to founder at once.

My object in alluding to this gale is to show that these waves of low pressure exist on the American side of the Atlantic. As I have before said, diagram 5 shows that the "Austrian" passed through another before she got to Portland, though it was not so bad, or it may be that she did not get the worst part of it, for by the changing of the wind we know that a lower pressure passed to the south of her. Then again, the steamship "Delta," bound from Halifax to Bermuda, which left Halifax at the same time as the "City of Boston," passed through two of these waves of low pressure in three days as she steamed to the southward, changing the temperature of the sea 20° in 8 hours.

The cause of these areas or waves of low pressure does not seem to be clearly understood, but it is well known that whenever hot and cold water are in close proximity, there will be great atmospheric disturbances.

By turning to diagram 4, it will be seen that in this very neighbourhood, in the month of January, 1868, there were waters at temperatures of 60° and 32° in close proximity; and it is worthy of notice, that the "Austrian's" sea temperature went up 8° as her barometer commenced to fall.

During my 30 years at sea, I cannot remember to have once passed through the hot current to the eastward of the Agulhus Bank, S. of Africa, without getting a very unsteady wind or calm. When we con-

sider that hot water exists there all the year round, whilst in the Cape winter the barometer on land is from two to three-tenths higher than it is in their summer, we have a sufficient cause for a steep gradient running on a N. and S. line, and in the southern hemisphere with a high barometer to the N. and lower to the S., there will be a W. wind proportioned to the amount of difference. This seems to account for their heavy Westerly gales at that season.

Effect of Hot and Cold Water on the Barometer.—By referring to diagram 3, it will be seen that the barometer has a general tendency to rise over the cold water, and a strong Northerly gale blows where the hot and cold water are in close proximity; the same tendency to a Northerly gale in the same place is seen on diagram 4. I have frequently noticed this on other diagrams sent in by Captains, which has convinced me that, other things being similar, the barometer will be lower over hot than over cold water, and that there will be a tendency in the wind to blow along the line joining them.

After working up the North Atlantic data now in hand, we hope to trace some of our gales in their easterly course, when we may be able to say more on the subject.

Besides the occasional areas of low pressure with their accompanying winds, it is not uncommon for isolated areas of high pressure to appear, round which the wind blows in an opposite way to what it does round an area of low pressure.

For instance, suppose that an area of low pressure existed over Ireland, we in England should get a South wind, whilst if it were replaced by an area of high pressure we should get a North wind, which would draw to East on the south coast of Ireland, South to the west, and West to the north of that island.

It is clear then that as the wind blows round isolated areas of high and low pressure, though in opposite directions, each will be accompanied by winds from all points of the compass. But, as may well be supposed, the South wind on the west side of an area of *high* pressure may differ very much from the South wind on the east side of an area of *low* pressure, the latter being very commonly warm and wet, whilst the other may be cool and dry.

The wind round an area of high pressure has been called by Mr. Galton an anti-cyclone, on account of its reversing the order in which it revolves round a cyclone, and it is thought by some that, as the area of high pressure to the northward of the trades is supposed to be supplied by a descending current of air, so are all areas of high pressure. This would account for our East winds being so cool and dry.

It must be remembered that the direction of the wind depends on the shape of the area of pressure which accompanies it. If a bank of high pressure lies to the north of any place there will be an East wind until it disappears.

Theories on the Cause of Wind.—We will now turn to various modern theories as to the causes of wind.

Mechanical Theory.—1st: There is what may be called the mechanical theory lately put forward by Mr. Laughton of the Royal Naval

College at Portsmouth, in his interesting little book "Physical Geography in its relation to prevailing Winds and Currents."

He supposes that the prevailing Westerly wind of high latitudes is caused by the influence of the moon, and that the modifications of this wind caused by the coasts which bound the sea, are the sources of all other winds. For instance, he says when our Westerly wind strikes the Coast of Portugal, it will branch to the N. and S. as any fluid would do under similar circumstances, and that eventually it will recurve to the westward to fill up the space from which the air forming the original Westerly wind, had moved. Thus eddying as it were in two great circuits, and carrying the surface waters with it, causing the main currents of the ocean.

There can be no doubt that land frequently offers an obstruction to a current of air and diverts its course, but this theory does not take into account the changes which come with the seasons; they seem to be due to temperature, a force which Buchan seems to think is the only cause of wind, and to the effect of which I will now allude.

Temperature Theory.—Suppose that the earth were covered with air at a certain temperature, say 60° , without any disturbing force, it would most likely form an envelope of equal height and at rest. But if by some means the air of the equator were heated to 83° and that at the poles cooled to 32° , then the heated air would expand and rise, whilst the cooled air would contract and lie lower, leaving room above it for the heated air to flow in, cool down, and so raise the barometer, at the same time that the flowing away of the air from the heated parts, would lower the barometer near the equator. A further loss of pressure is caused by the condensation of the moisture in the air as it rises, which produces the large amount of rain in the equatorial doldrums, and of course takes so much from the weight of the air.*

All seamen know that there is an upper current of air from the equatorial doldrums travelling to the North, for they have seen the clouds which it carries. But as land heats more quickly than water, and does not give out so much moisture for cloud, it is supposed that the air also rises over tropical lands and flows seaward (though clouds do not so plainly indicate this current), descending where it finds a relatively cool spot. Dust from volcanoes has been known to travel several hundred miles in the direction of such an upper current. In this way the area of high pressure in the North Atlantic is supposed to be supplied with air, out of which it flows as a descending current.

Then again, the area of low pressure in the neighbourhood of Iceland is very much more decided in winter than in summer, just at the time when the sea there will be very much warmer than the neighbouring land; for it is well known that water changes its temperature slowly whilst land is quick in its changes, hence we may conclude that water will be relatively cooler than land in summer and warmer in winter, on this fact seems to be based the cause of our strong winds in winter, in comparison with our lighter winds in summer.

* It is worthy of notice that in the centre line of our waves of low pressure, where the barometer is lowest, there is generally heavy rain just before the wind shifts to West and the barometer begins to rise.

The same cause may be supposed to account for stronger winds and more disturbed weather prevailing in the tropics in the hot season, because there the coolest air being over the water, the difference of pressure over land and water is intensified by more heat, whilst it is lessened by the same force in high latitudes.

A combination of the two theories to which I have alluded, seems to account for much that is known of the winds of the North Atlantic.

Effect of Seasons on Areas of High and Low Pressure.—The effect of seasons is strikingly shown by the travelling northward, during our summer months, of the N.E. trades, and of the area of high pressure which bounds them on the N., as well as of the zone of equatorial doldrums to their south. These changes are accompanied by a much more constant Northerly wind on the coast of Portugal than prevails in winter, and by a prevalence of Southerly wind on the American coast. Here we seem to have a clue to the reason why our English climate is so much less extreme than that of America in the same latitude, for it will be seen that the area of low pressure which prevails in winter near Iceland tends to draw a S.W. wind over the British Islands, and a N.W. wind over America; but when summer comes on and this area of low pressure almost disappears, the area of high pressure at the northern verge of the N.E. trades is driven northward, tending to draw more Northerly winds over England, and more Southerly over America.

Apparent Cause of our Easterly Winds in Spring.—Whilst alluding to the effect of these various dispositions of air on our climate, it may be well to remark on an apparent cause for our Easterly winds in spring. It is now fairly established that when an E. wind blows in England, there is a higher barometer to the N. and lower to the S. of us, and the question is, what causes it?

A similar disposition of the air exists at the Northern verge of the N.E. trades where there is an almost permanent E. wind. There we have strong evidence that the high pressure to the N. of the E. wind is maintained by the transposing of air which rises in the equatorial doldrums, and flows northward above the trade wind, descending over the calms of the "Horse latitudes," for clouds are frequently seen to be carried along by this upper current.

May we not suppose that in our spring, as the sun heats up Africa and Southern Europe, a body of air may rise and flow northward as an upper current, descending where the sun's influence is much weaker and the air lies lower, viz., to the N. of England. Many of my hearers must have noticed how a bitter E. wind frequently follows two or three unseasonably hot days in spring. May they not have been sending the air N., which eventually descended and caused the E. wind? We ought not to expect to see clouds in this upper current, as heated air rising over land does not carry so much moisture with it as it does in the equatorial doldrums over the sea.

Balance of Pressure over Land and Water, in Summer.—Then again, as Northern Europe and America heat with the advance of summer, more air is carried over the sea, and the balance of pressure over land and water is much more even, which as has already been said, seems to account for our winds being so much lighter in summer.

November Wave.—It seems worthy of consideration whether the November wave of high pressure which is so often noticed to pass over several northern stations, may not be the return of a mass of air to the cooling land, which had been more equally distributed over the sea during the summer months. The setting in as it were of that disposition of atmospheric pressure, which accompanies the strong winds of winter.

Climate of Iceland.—The summer of 1870 was particularly warm and wet in Iceland,* whilst it was very dry with us. Such a state of weather would result if an area of *high* atmospheric pressure existed to the westward of these Islands, for it would throw a warm South-westerly wind on Iceland whilst we should get it Northerly. One can quite understand how air transposed over the sea in summer, may not always accumulate in the same place, and therefore affect the climates of different countries variously.

Conclusion.—The few words which I have ventured to say on the causes of our wind and weather, seem to *point* to the truth, but none can feel more than myself how imperfect this lecture has been, and how much we have still to learn; it is to be hoped that the increasing number of excellent observations which are coming into the Meteorological Office will help us to more and more unravel the principles which govern the winds of the Atlantic and all other parts of the world.

* "Journal of the Scottish Meteorological Society," July, 1870.

LECTURE.

Friday, May 26th, 1871.

GENERAL THE RIGHT HON. HUGH H. LORD STRATHNAIRN, G.C.B.,
G.C.S.I., in the Chair.

THE WINTER CAMPAIGN OF LE MANS.

By Captain C. B. BRACKENBURY, R.A.

IN order to understand rightly the object of the short campaign, which I have the honour to bring to your notice this afternoon, and its chances of success, it seems necessary to sketch very briefly the previous phases of the war, which had step by step brought the opposing forces to the positions they held at the end of the year 1870.

It matters nothing for our present purpose how the war was brought about. Certainly the astuteness of the Prussian Chancellor was never more thoroughly shown than when he drew France on to become the aggressor in the face of Europe, and that while she was still unready. By virtue of the organization, the salient points of which I endeavoured to set forth a fortnight ago, the Germans were ready on the frontier perfectly equipped and concentrated in corps, so well prepared in peace that the Generals commanding knew all the superior Officers and many of the inferior ones, having been already accustomed to manœuvre with them, while the Officers knew their men and were trusted by them. Every department was in order, the fighting troops, the transport, the commissariat, the medical department, all were like polished weapons, resting sheathed during peace, yet not so idle but that they were occasionally drawn forth, inspected, and wielded during the autumn manœuvres, so that the hands of the commanders might not forget the cunning of their fence. Thus completely prepared, the Germans were gathered on the French frontier, while nothing but confusion reigned within the ranks of the aggressor. The railways were still full of men in uniform, rushing backwards and forwards to find their regiments and corps. The telegraphs were burdened with the messages of Generals to the War Office, praying for stores of one kind or another, without which they could not move, and with the answers of the War Office to their prayers. The brigades and divisions were in many cases composed of regiments which had never met before, commanded by Generals entirely unknown to the men, and sometimes untried. Just about fourteen days more were required to fit the French army

for the field, when the frontier was crossed by the Germans, and the corps of MacMahon, the right flank of the French army, was smitten so heavily that it reeled back in utter discomfiture. Then the rest of the Germans pressed on also, driving in whatever was opposed to them, and forcing back the whole French line. I believe this to have been a mistake, and that it was contrary to the intentions of Moltke, who would have cut off the French, and never allowed them to reach Metz.

Be this as it may, the blows had shattered the spirit of the French army, and almost destroyed its discipline, already impaired by indulgence.

By vigorous marching, and desperate, sometimes almost rash fighting, the German troops succeeded in heading the French, and shutting them within the intrenched lines near Metz. MacMahon, with the remnants of his corps, a large number of almost mutinous mobiles, and a heterogeneous mass of soldiers, who had straggled into the Camp of Chalons from all parts of France, undertook a march which might have been possible for a well-trained and well-organized army, but which ended in the sweeping of himself and his soldiers from the soil of France. Then came the march upon Paris, and a small fight to the south of the city, ending in the withdrawal of all the French soldiers within the forts or the town itself. The iron net was drawn slowly round, and a great multitude enclosed, out of which Trochu tried in vain to form a manageable army.

Startled by the suddenness of the past events, the world in general imagined that Paris would fall almost immediately, and refused to believe in the reality of an army said to be gathering southwards on the Loire. Perhaps even the Prussian Generals doubted the existence of this army, they certainly disbelieved in its efficiency, for they suffered the Bavarians, who alone stood between the army investing Paris and the South of France, to be attacked sharply by that very army of the Loire, and driven backwards in haste. At this moment the fortunes of France were by no means desperate. Bazaine detained round Metz the whole of the army of Prince Frederick Charles, the barrier of investment round Paris was very light, one of its supporting buttresses, Von der Tann and his Bavarians, had been driven in. Nothing seemed to stand between the army of the Loire and the relief of Paris; nothing could have hindered that relief, had the Loire army been composed of Prussian reserve or landwehr men. But it was made up from the remains of some line battalions and the motley crew which form the French reserves. It was unable to push forward rapidly, and while it was hesitating and delaying, there came a cry from the north-east that Metz had fallen, and that without one hour of delay part of Prince Frederick Charles's army had commenced its march downwards to the Loire. The Grand Duke of Mecklenburg advanced to the support of the Bavarians, now in heart again, and the Red Prince pushed the whole of his army in the same direction. They caught the French in front of Orleans, and broke the army of the Loire, driving part of it up the river, part of it down, and others across it. Orleans was occupied, and after very stubborn fighting the French

corps under Chanzy was forced westwards beyond Vendôme, whence, for want of provisions and ammunition, it is said, they finally retired to Le Mans, occupying the country between it and Vendôme only by very small detachments.

Though the French had been defeated, they still outnumbered their adversaries, and continued to gather, forming two great armies, one with the head-quarters at Le Mans, under Chanzy, the other commanded by Bourbaki, who fixed his head-quarters at Bourges. This then was the position of the opposing armies at the end of 1870.

Mecklenburg, with one corps, formed of the 17th and 22nd divisions, was at Chartres, between Chanzy's army and Paris. The remnant of the Bavarians, under Von der Tann, had been sent back near Paris to recruit their shattered ranks, not before it was time, for they had been reduced to about one-fifth of their original strength. Prince Frederick Charles with three corps, and a large cavalry force, had to guard Orleans and the Loire, both above and below the city of "The Maiden." The 9th corps, consisting of the Hessians and 18th division, Schleswig-Holsteiners, guarded the city and pushed out detachments both in front of it and to the left, up the river. The 3rd corps, 5th and 6th divisions, both formed of Brandenburgers, Prince Frederick Charles's own corps, was on the left, still further up the Loire. The 10th corps, 19th and 20th divisions, Hanoverians, occupied Blois and Vendôme, with the country between, and held the Loir (not to be confused with the great river Loire), facing Chanzy's army towards the west. The men were in splendid condition, full of vigour, and confidence in their commanders, somewhat savage at being kept so long from their homes by the protracted defence of Paris, and eager to do their part in bringing the war to a sudden end.

The French were in far other plight. Letters taken at Vendôme after the second capture of Orleans, showed that mistrust of their Officers and all but despair prevailed among them, and they were actually being reorganized as an Army in the front of the enemy.

Shortly before the campaign of Le Mans commenced, Gambetta issued an order which changed the composition of Chanzy's army. Hitherto there had been regiments of the Line and battalions of Mobiles. The troops of the Line had some of the qualities of disciplined soldiers; they knew their drill, and were accustomed to obey orders; but they had been drawn from many sources, had no *esprit de corps*, and were little acquainted with the Officers placed over them.

On the other hand, there had been gathered throughout the whole of France—from the château, from the plough, from the vineyard, and from the factory—a vast number of young men hitherto little trained to military service. They were full of courage and high hope, their enthusiasm was real and likely to influence others; they loved their country, and could not bear to lead soft lives while France was bleeding, and on her knees. They represented very nearly our own Volunteer forces, while the soldiers of the Line were like such a body as would result from bringing together all the recruits of six months, all the *dépôts*, and some of the pensioners of the English Army. The Mobiles generally knew their Officers, and had even some hand in choos-





ing them. It occurred to Gambetta that an amalgamation of the two classes would have a good effect upon both—the Mobiles would learn military manners, the regulars would gain all the force of enthusiasm. But such effects require time for their realization, and Paris—the hope of France, the centre of civilization—was beleaguered and in danger of falling through sheer hunger. Above all, it was necessary to proclaim to the world that the Republic had quickened the dry bones of the Empire, and that the great nation was rallying from the surprise and shock of invasion. For these reasons, and to teach the young soldiers that the sound of the rifle was not always followed by sudden death, nor would cannon always destroy, Chanzy sent forward some of his divisions to the neighbourhood of Vendôme, threatening the Prussian outposts; and at last, emboldened by immunity from serious danger, waxed haughty, and sent a letter bearing the nature of a challenge to the Prussian Commandant of Vendôme. It said, in effect, “You are robbers and devastators. You have beaten me once, and you have since lied in the face of Europe, saying that you have beaten me always. My Army is now ready; come out and we will settle this quarrel.” The Commander of the Hanoverians sent the letter to his Chief at Orleans, saying that he, for his part, knew not what answer to give to such a document, which differed strangely from all that he had read in the history of warfare. His only reply was to bid his men hold fast to their posts, and guard patiently the line of the Loir. Chanzy’s letter was published in the French journals, and telegraphed to England. I know not whether it really influenced the commanders of the German armies, but I know that each man at Orleans felt that he had a challenge to accept—an insult to avenge. Be this as it may, it was about this time, or but little later, that the Royal Field-Marshal began to draw his troops together.

For some days before the end of the year there had been sharp skirmishes between the outposts in front of Vendôme, and one of them was so characteristic of the opposing armies, that I will crave your indulgence for reading the description I wrote of it at the time:—

“On Christmas-day certain *Frances-Tireurs*, or, as the Germans say, “the inhabitants of the hamlets, having neither the love of good cheer nor the fear of the enemy before their eyes, fired upon some of the “wide-ranging cavalry patrols sent constantly to roam throughout the “district. This was by no means to the mind of General von Kratz, “who, receiving a report of the occurrence at Vendôme, forthwith “ordered a detachment of troops under his command to march the “next day. On the 26th of December, therefore, a small column left “Vendôme—two companies of the 2nd battalion and the whole Fusilier “battalion of the 79th regiment, one squadron of Uhlans, and two “guns from the 4th light battery. The rest of the 2nd battalion was “no longer at Vendôme, having been despatched to the rear on the “unwelcome task of guarding prisoners. Lieutenant-Colonel von “Boltenstern, of the 79th, was in command. His orders were to advance as far as Montoire on the 26th, and send cavalry patrols “forward to reconnoitre. On the 27th he was to push on through “Les Roches, leaving half a company at Montoire, a company and a

“ half to hold the bridge at Les Roches, and occupy the two villages, “ the misdeeds of which had caused all this turmoil. Infantry of the “ enemy were likely to be found further on by the bank of the Braye ; “ if so, he was to dislodge them, and remain that night as the un- “ bidden guest of the villagers, while his cavalry should watch the “ heights on the right up the river. He was to return next day to “ Montoire, the day after to Vendôme.

“ Obedient to the orders given him, Colonel von Boltenstern marched “ on the 26th, and rested that night at Montoire. His cavalry patrols “ were vigilant that evening and night, so that the enemy did not “ appear on the hither side of Sougé. Next day, the 27th, a small “ company of soldiers issued early from Montoire—the advanced “ guard of the force—then followed the main body, and, lastly, a rear “ guard. Behind them remained half a company to hold the road and “ protect a small bridge which leads off the main road across the river “ hard by. The men wore their great coats, for the day was cold, “ and there was little fear of surprise on the march, the way being “ always pronounced clear by the Uhlans, who had watched in turns “ through the night, and now examined every spot where danger “ might lurk.

“ The advanced guard approached Troo, and then first met with “ opposition from the enemy, who, sheltered by the houses and walled “ gardens, poured forth such a fire as checked the advance. It was “ manifest that the object of the Commander was not to be attained “ without fighting, and there would have been excuse enough for a “ retreat. But the orders given were that the column was to march to “ Sougé, and to Sougé the Colonel would go. The combat lasted two “ hours before the French gave way, and were thrust out at the other “ end of the village. This point, once gained, must not be lost, so a “ company was left to hold the place while the column advanced. “ Sougé was soon in sight, but was found to be occupied by the enemy “ prepared to defend it. On the heights to the right above the Braye “ were seen three dark lines—each a French battalion, and the presence “ of artillery with them was soon equally manifest. Still the Colonel “ was undaunted, and returned fire for fire. The combat was waxing “ warm when the attention of the German Officer was drawn to a new “ danger gathering in his rear; the heights by which he had lately “ passed were becoming crowded by Frenchmen, whose object was to “ cut off his retreat. Foes in front, foes in rear, there was no chance “ left but that of cutting his way back to Vendôme as best he might. “ He fell back swiftly through Troo, picking up as he went the com- “ pany he had left there, and endeavoured to reach Montoire before the “ enemy could overwhelm him. The men marched fast, and had well- “ nigh gained the wished-for shelter, where also some of their comrades “ had been left in the morning, when suddenly a row of armed men “ appeared in front blocking up the road, and stretching right across “ the valley from hills to river. The enemy’s infantry rushed after “ him through Troo, where he had not now a friend, and the guns he “ had resisted before thundered behind him, sending shells among his “ men ; more guns crowned the heights on the left rear ; rifle bullets

“from the infantry in front whistled through the air; many a spiked helmet sank from its place; on the right rolled the icy waters of the Loir, bridgeless, until that line in front could be passed. Surely the idea of surrender must have entered his mind? If so, it was but for a moment. He had been ordered to go to Sougé, and he had gone; to return to Vendôme, so to Vendôme he would return. To keep his troops in a mass would be to insure their destruction by the concentrated fire of the enemy from three sides. He scattered two companies into skirmishing order, took the rest of his infantry in hand, and sent them full at the enemy; the guns followed as well as they could, five horses having been killed out of the nine which left Montoire that morning. No sooner were the foot soldiers let loose than they sprang upon the enemy. The line that barred their passage hesitated, wavered, and broke; too soon for success, too late for safety. There was no time to count killed and wounded, nor the prisoners whom the Germans took and drove before them as they went. The barrier was down and Montoire was gained. Even then the way home was not clear, because the main road led through Les Roches, the road to which was blocked by two French battalions with artillery, and the half company left there had been driven back long before. The enemy's guns still sent shells from behind and from the heights on the left, and infantry was coming up the road firing upon the rear of the Germans. Steadily their Colonel called his men to him, steadily they gathered and trimmed their ranks, and steadily they crossed to the left bank of the river, carrying their prisoners, uncounted as yet, with them. For some time the hostile infantry pursued along the road; then all was quiet, and the Germans marched through the twilight and the darkness, always driving their herd of prisoners until they got back, according to order, and the Colonel reported himself at Vendôme about an hour before midnight. He had lost out of his command, in round numbers, 100 men. One Officer had been killed, four wounded, and one was missing, supposed to have been taken at Montoire; but when the unwounded prisoners came to be counted it was found that there were ten Officers and 230 men.”

Such being the conduct of a small body of Germans in great peril, outnumbered and without hope of succour, it is no longer matter for surprise that when the whole army moved, the French were unable to offer more than temporary resistance at any point. The Germans had the advantage of the initiative, and their march was so calculated that the events of each day came to pass almost exactly as had been previously arranged.

The general plan was to advance by different roads towards the line of the Loir, drive back the French divisions annoying the garrison of Vendôme, march to meet the army of Chanzy, attack it wherever it might stand, and, proving to the world the superiority of the German arms by the capture of Le Mans, relieve the investing army before Paris of all fear for its safety.

The 3rd Corps, consisting of the 5th and 6th Divisions, was to cross the Loir in the neighbourhood of Vendôme; the 18th Division (of the

9th Corps) was to pass at Morée, higher up the river, and, having cleared the way, to act as reserve. The 10th Corps (19th and 20th Divisions) was to march down the river to La Chartre, and be always ready to turn the French right, arriving finally with the rest before Le Mans. The Grand Duke of Mecklenburg was called down from Chartres to drive in Chanzy's left. Duke William of Mecklenburg, lately joined after recovery from the explosion at Laon, was to keep the left of the Prince's forces with the 6th cavalry Division. The 2nd cavalry Division was to show the ability of Prussian horse by spreading out and keeping communications open between the left of the Grand Duke and the 9th Corps on the Prince's right. The right of the Grand Duke was to be protected by the 4th cavalry Division, and the 5th cavalry Division was to take care that no considerable force of the enemy should appear in all the country north of the Grand Duke's army.

On the 2nd of January the head-quarters of Prince Frederick Charles were at Orleans. The Grand Duke was at Chartres; the 5th and 6th Divisions were distributed between Meung and Mer on the Loire; the 18th Division was at Châteauneuf, up the river on the other side of Orleans; the 19th was at Blois, and the 20th at Vendôme, covering with their detachments the line of the Loire and the passage of the Loir at Vendôme, together with the whole of the road between the two towns. On the side of the Grand Duke, the 17th and 22nd Divisions had their head-quarters at Chartres and their outposts in front of the town facing the French.

January 3. No change worthy of note in the army of the Prince. The 22nd Division moved to Courville on the road and railway in advance of Chartres.

January 4. The Prince moved his head-quarters to Beaugency. The Grand Duke remaining at Chartres, the 5th and 6th Divisions (3rd Corps) concentrated in and about Marchenoir. The 18th Division (9th Corps) was drawn forwards to Orleans; the 19th remained at Blois, and the 20th at Vendôme, skirmishing in advance of it with General Chanzy's outposts. The 17th and 22nd Divisions and the 4th cavalry Division concentrated between Chartres and Courville. The 2nd cavalry Division took care that no enemy should slip in between the two portions of the army; the 5th cavalry Division covered the right of the whole.

January 5. The Prince moved to Oucques, somewhat in advance of Marchenoir, the 3rd Corps (5th and 6th Divisions) planting their head-quarters in the same little place, and spreading out their outposts in advance of their Commander-in-Chief. The 18th Division now took its place on the right of the force, under the immediate command of the Prince, but somewhat in rear. It moved from Orleans to Ouzouer-le-Marché. The 20th Division remained at Vendôme, always skirmishing with the French, and the 19th moved up on its left from Blois to St. Amand. The Grand Duke pushed on his troops, keeping them about him round his head-quarters, which he carried southwards to Illiers. Between him and the 18th Division at Ouzouer the 2nd cavalry Division kept guard; the 4th was with him, and the 5th now, and always, covered the right flank of the whole moving army.

Not to check the current of details concerning the march on Le Mans, it may be well to say here that on the 6th Duke William fell in with heavy forces of the enemy near Villeporcher, and could not proceed. On the 7th General Hartmann was despatched with reinforcements from the 10th Corps in the direction of St. Amand, on which the French fell back towards Tours, most of the troops being sent by railway thence to Le Mans. General Hartmann commanded a detachment consisting of the 1st Cavalry Division and a brigade of infantry from the 19th Division 10th Corps. He followed the French to Chateau-Renault, where he waited some days, but finally pushed on and occupied Tours on the 19th of January.

On the 8th a second detachment was formed, under General Schmidt, at Montoire, consisting of his brigade of the 6th Cavalry Division (eight squadrons), one battalion of infantry, and six guns. From that time forth he covered the right of the 10th Corps, as its march was removed some distance from those of the other columns. The other brigade of the 8th Cavalry Division was with General Hartmann till the 9th of January, and then joined the 10th Corps.

All the marches from Orleans had been made in bitter weather. The ground was hard as iron, three or four inches of snow lay upon it, and a piercing wind whistled round the heads of horse and foot soldiers. Whatever moisture was exhaled from sturdy lungs, or healthy skin, froze instantly, and covered hair, beards, and great coats with sparkling white rime. Icicles hung heavily from moustaches, and formed curious frames for the inevitable pipes or cigars which protruded from all mouths.

On the 6th January there was some sunshine, and the march to Vendôme was not unpleasant.

The 18th Division reached Morée, on the Loir, north of Vendôme, and made its passage secure. The 5th Division crossed at Vendôme, and there first encountered the enemy. Support would have been given by the 6th Division, but its march, to the right of the 5th Division, was so long that it could not come up in time. It appeared that the French had been on their way to attack Vendôme in some force when they were met by the 5th Division, and forced back beyond the line Azay Villiers, where the Prussian division halted for the night. About 500 prisoners were taken.

The 10th Corps (19th and 20th Divisions) drew off from Vendôme, hitherto so well guarded, to Montoire, attacked on the left flank by the French, who also came in contact with Hartmann's detachment. After some fighting the corps occupied Montoire, the detachment was checked, and lay at night on the line Huisseau-Cruchery between Vendôme and St. Amand.

Duke William with his cavalry came into a hot contest near Villeporcher, and could not force his way forward. So the left of the advancing line was checked for a few hours. The centre and right had succeeded admirably. The French accounts given to the world spoke of the check at Villeporcher as of a battle won. They were silent as to the Prussian direct advance from Vendôme.

Here I would remark on what seems to me a prominent and peculiar

feature in the Prussian system, both of strategy and tactics. Part of a line, be it a corps or a company, is suffering heavily and cannot proceed. Instead of sending help to it the other portions of the force press on all the harder and straighter, confident that by their success the halt of their friends will soon become a triumphant advance, and thus it happened with the 10th Corps, which was relieved by the steady advance of the 5th Division. This gallant division marched from Ouques in the morning, fought all the afternoon, and won Mazangé for its head-quarters in the evening.

On the same day the Grand Duke moved his head-quarters and the 17th Division to Brou, the 22nd to La Loupe and La Fourche; the 4th Cavalry Division was at Combres, the 2nd always watching between Mecklenburg's army and the right of the Prince, the right flank guarded still by the 5th Cavalry Division.

January 7th. On the night of the 6th the frost broke up so that on the 7th the roads were covered with melting snow, the ditches were fast becoming running streams, and the rivers were more impassable than usual. Vendôme was in sunshine, but the higher ground across the Loir was shrouded in a dark fog, sometimes concealing all objects at a distance of 100 yards, sometimes lifting for a few moments and permitting a brief glimpse of the rolling hills, made almost to be defended, with flashing streams not easy to be crossed, if bridgeless, at their feet.

The 10th Corps was delayed by the attack of the French on Duke William, and it was only next day, when the enemy had retreated towards Tours, that its march was resumed. No doubt this lost day saved Chanzy from worse than actually befell him.

The 5th, 6th, and 18th Divisions pushed steadily on, feeling their way through the mist, and coming in contact occasionally with the rearguards of the enemy's columns. At the end of the day the head-quarters of the different divisions stood as follows, the outposts being always some distance in advance on the Braye:—5th Division, Savigny to the left of the main road; 6th Division, Sargé to the right of it, both on the Braye; 18th Division, Epuisay, on the main road. The Prince was with the troops on the road, but returned to Vendôme as soon as he received reports that the positions assigned to the various divisions were in their occupation. Further to the right the 2nd Cavalry Division swept the country between the Prince and the Grand Duke.

Mecklenburg moved his head-quarters to Beaumont-les-Autels, the 17th Division reached Anthon, the 22nd extended southwards from Nogent-le-Rotrou. The 4th Cavalry Division crossed the railway on its way from Combres, and dismounted at Remalard on the Huisne. The 5th Cavalry Division had still charge of watching the right of the advancing armies, taking care that no foe should appear between them and Versailles.

I am less careful to direct your attention to the strategy of this campaign—a simple enough piece of well-devised concentration—than to show how thoroughly both Officers and men become trained by the system of peace manœuvres, so that when war comes, it finds them

ready to act with the greatest intelligence and perfection of knowledge. I will, therefore, if you permit me, read the description I wrote the same evening, while the affair I had seen that day was still fresh in my mind and memory. But for the horror of the slaughter, the wonderful hound-like sagacity of the Prussian soldiers would have been a source of unmixed admiration.

Imagine a straight road leading over a succession of round hills. On either side of it a rich country, full of farm-houses, cottages with orchards and walled gardens and hedges, exactly like those of England. Occasional, but not frequent, woods. In fact, if you combine Kent and Surrey, and put vineyards for hop-gardens, you will have an exact mental picture of the country through which the Germans were pushing on with all the disadvantage of the fog in a land never seen before.

"The column was led by a small detachment of Cuirassiers. After them came three infantry soldiers, two of them about 150 yards in front of the column, and one behind to connect these foremost men with the detachment of infantry which came next. The three foremost soldiers of the German Army in face of the enemy, were accompanied by four pet dogs, trotting quickly along beside them. After the infantry detachment was a squadron of Cuirassiers, then more infantry, all of the same regiment, and after them the light battery of the advanced guard. The mist was sometimes so thick that objects were invisible at 100 yards in front, and the troops moved cautiously, for they knew that the enemy might be felt at any moment. The pace was a moderate walk, about three miles an hour, with occasional halts to examine a farm or a group of cottages near the road. Right and left of the road were cavalry and infantry marching in pairs, questing, like dogs, for game. They were generally concealed by the fog, but now and then a small party would peep out from a lane or cottage garden, and vanish again into the mist, when they saw that all was going smoothly, and they had not lost their place beside the column. The troops, marching along the undulating road, had no reason to take thought for anything except what lay in front of them, for they were confident in the sagacity of their comrades, who were pushing on as well as they could over vineyards and gardens, ploughed fields and stubble, walls and fences, peering into every tree and bush, sometimes walking quickly over the fields, sometimes, with rifle at the charge, seeking carefully for any enemy who might possibly be concealed by a copse, a garden wall, or a cottage. Occasionally a man would run to the road and report something suspicious-looking. Instantly some of his comrades were sent in the direction named to ferret out any Frenchman who might be lying hid there. All this was done so quickly and with such thorough professional ease, that the column on the road could tramp slowly along almost without check.

"After a time there was a halt. The red trousers had been seen to the right for a moment, and had immediately disappeared in the fog. The quest was made with increased numbers and redoubled caution among the small fields and hedges, exactly like the country in

"England. No sign of the enemy. The march was resumed again, and continued until the few horsemen in front rode back to the head of the column, reporting something like men on the road. Slowly the infantry advanced, straining their eyes to catch a glimpse of the obstacle, whatever it might be. The fog thickens, and closes in the view to within a few paces. The foot soldiers feel their way onwards, still straining their eyes and stretching out their necks. The fog becomes gradually lighter, and something seems to grow out of it, dim figures-assembled together, and above the group an appearance like the erect quills of a porcupine. Soldiers, probably with bayonets. Instantly there is a murmur, 'Are they ours?' Has one of the questing parties gone a little too much to the front? Not so. The figures remain still, and seem to block the way. 'Cuirassiers to the front.' There is a sort of good-humoured growl, and some one says, 'Yes, it is always Cuirassiers here, Cuirassiers there.' But the order has been given, and the Cuirassier knows no other obligation than the call of duty. The men, who had been brought in behind the infantry detachment, draw their swords, set their helmets firmly on their brows, close their knees with firm grip on their horses, and file past the infantry once more to the front. 'Trot!' The fog comes down again, and the dim figures with the spikes become once more invisible; but not unheard. The horses are hardly in their stride, and have not gone more than half the 400 or 500 yards uphill in the direction given to the riders, when a crackling noise is heard and the air becomes filled with a whizzing sound as of innumerable heavy insects flying faster than insect ever flew before. Every horseman bends to his saddle-bow. The Officer who leads them is seen to waive his sword, and heard to give a word of command. The Cuirassiers who went at a trot return at a gallop, but always steadily and in order, followed by those swift hornets with the fierce stings. Like magic the foremost infantry soldiers dissolve; not, however, to retreat. They spring to the sides of the road into the ditch, full of half-melted ice, and into the fields, and begin in their turn to creep forward. The enemy is still in the mist, though near at hand, and as the hornets come thick and fast the squadron of cavalry now occupying the front place seems inclined to follow the example of the infantry, and dive for shelter. But such is not their part in battle, and one simple 'No,' in an ex-postulatory tone, from their Commander, recalls them to their steady attitude. One of them, and not the least steady, remarked quietly, 'These French Chassepôts shoot so far that one gets killed without seeing them. A comrade of mine was shot yesterday in the middle of his heart, and I don't think he even heard the rifle.'

"Cavalry are of no use where these men stand, so their Officer soon draws them off into a field at the side. On the left, behind a house a little removed from the road, cavalry patrols are calmly waiting under shelter. Along the straight road for miles is a column of infantry, artillery, and train. Now for the mitrailleuse at work in its proper place. Its horrible growl must have been expected by many, but it came not. The French always seem to do the wrong

"thing. Their shells burst high in the air, and they hit their mitrailleuses against field artillery at long ranges.

"Meanwhile, the infantry soldiers work steadily forward, firing at the flashes of the enemy's rifles, and helping to create a denser cloud than ever, though the sun makes at that moment, half-past twelve o'clock, a vigorous attempt to break through the fog. The fight seems partly transferred to the fields, for the bullets fly more at the sides of the road, and strike the trees with a sound like the chopping of an axe. Several minutes go by—long minutes when the hornets are whizzing past with their sharp stings. The firing increases in intensity and rapidity, but there are several shots now for every bullet that comes down the road or at the sides. The voice of the needle-gun, too, sounds further off, while it grows more voluble. It increases to a heavy fire as more men come up. Still the French hold their ground. Guns begin to press forward, but there is no place for their effect to tell, and they do not fire a single shell. The sounds grow faster and fiercer. The combatants approach each other. How the poor French boys' hearts must be beating as the big Germans draw near! But there is now no more time for thought. A loud hurrah makes the mist quiver again. The Prussians have skirmished enough; they bound forward, reckless of consequences, and carry the position by storm.

"It was only an incident which checked the march for a few minutes. It is past, and the Prussians move on, looking sadly at the stretcher with its straw, and the fine young fellow with the pale face trying to support his broken arm and save it from the swing of the bearers; looking yet more seriously at those forms lying quietly by the side of the road, their faces covered decently from the light, which they will see never more. It was only a parapet and trench thrown up across the road before Epuisay, and it was carried 'with slight loss.' Will they think so, those women in the little house in the Fatherland, when the news comes to them? The news will come, for there is plenty of time to-day, and the corporal examines the bodies, and makes entries against their names in his book. Not wounded, not missing, no room for doubt. Dead, dead, dead!

January 8. The thaw of the day before had been succeeded by a sharp frost in the night. The roads were in good order for infantry, but there were many frozen pools, which made it necessary for cavalry to take good heed to their steps. The Prince moved his head-quarters to St. Calais. Not far in front of him were the 5th and 6th Divisions; the 5th southwards, the 6th northwards of the high road. The 18th Division surrounded him in St. Calais, forming a reserve to the advanced divisions. The 10th Corps had broken loose from its impediments at last, and reached La Chartre on the Loir with both its divisions, whence it was to march directly upon Le Mans. But the left of the Army had still to be watched, and General Hartmann moved only from St. Amand to La Foucherie, near Longpré, on the Brenne, a small tributary of the Loire, rising near St. Amand, and falling into the great river at Vouvray, not far from Tours.

La Chartre is far from St. Calais, and many a danger might lurk between. It was to guard against such that General Schmidt's detachment was formed. Its position on this day was at Vancé.

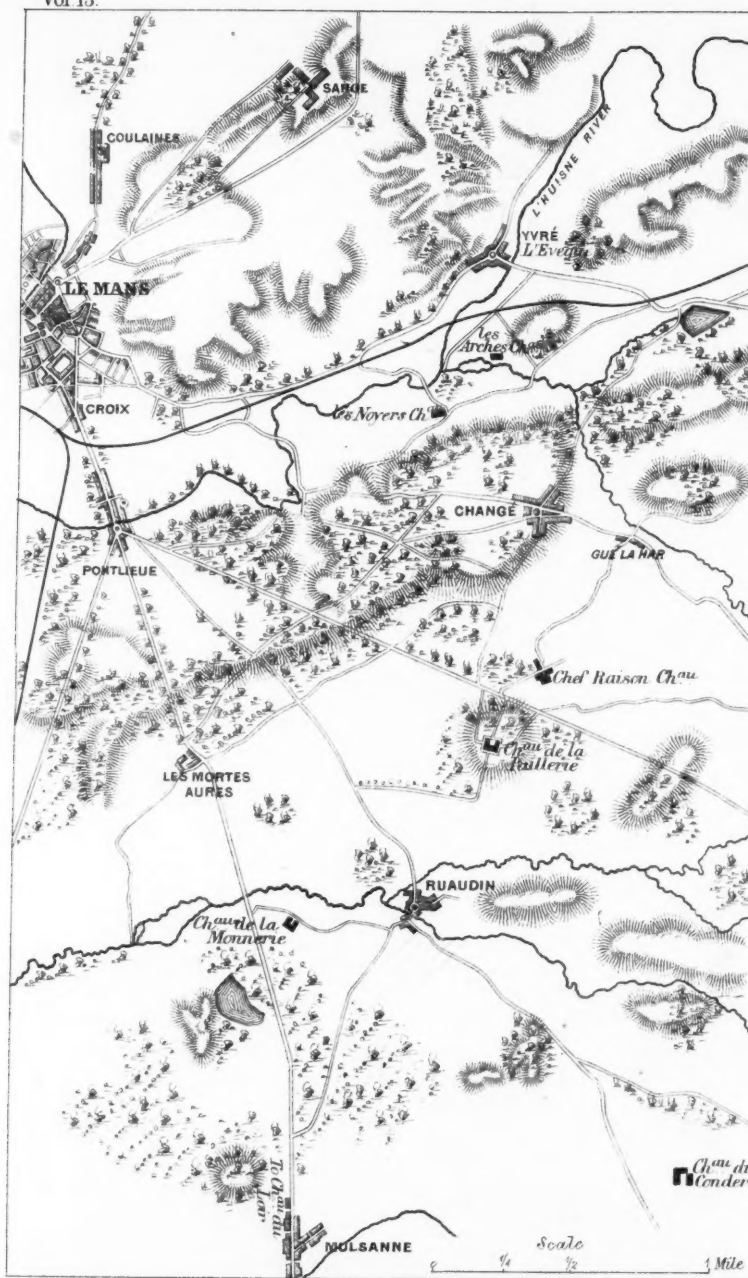
The Grand Duke of Mecklenburgh reached on this day La Ferte Bernard with the whole of the 13th Corps; the 4th Cavalry Division marched down the right of the Huisne from Remalard to Bellême. The 2nd and 5th Cavalry Divisions kept up the feeling with the 18th Division, and watched the right as before.

January 9. During the previous day, though the roads had been hardened by frost, the sun had power to thaw them again to some extent, and marching had been easy in the afternoon. But this morning the Army of Prince Frederick Charles awoke early to find that the cold had again seized upon the earth. The roads were hard as iron. Where water had stood last evening there was now ice. The sky was lowering, and snow began to fall. It was soon beaten down by the feet of men and horses or the wheels of artillery, and became ice in its turn. The magnificent French roads are paved in the centre, which is raised above the sides, so that there is no part of the way quite level. The paved *chaussée* was covered with a sheet of ice. At the sides were rough lumps of earth equally slippery. From this moment until after the entry into Le Mans the action of cavalry was almost paralyzed.

It was strange to see that persevering Army struggling on over the icy roads. Even the Prince himself had to dismount and walk. Most of the staff and cavalry escort were dismounted too, others forced their horses to stumble on in the ditch by the side of the road, still carrying their riders. The horses of the artillery and train were falling every instant, and ice nails became worth nearly their weight in gold.

So the Army pressed on—slipping and falling, but never halting—always driving before it the French, who had hesitated too long to descend on Vendôme, and were now recoiling from the first shock of contact with the Brandenburgers on the hills above the Loir.

On this day, the 9th January, head-quarters were moved to Bouloire. The 5th and 6th Divisions were at Ardenay and along the line of the Narrais. In response to Chanzy's challenge to the game of war, Prince Frederick Charles had played his pieces so well that it was already "Check to Le Mans!" The 18th Division still followed in support and gathered round their chief at Bouloire. The 19th Division was about Vancé, the 20th at Grand Lucé, already on the road from Tours to the devoted Le Mans. General Hartmann held his detachment at Chateau Renault ready to pounce on Tours, which had hitherto been debatable ground touched but not held by the Germans. General Schmidt's detachment stood that night eastwards of Montreuil, on a line between Bouloire and La Chartre, but nearer to Bouloire. The Grand Duke moved his staff to Le Luant, near Connerré, whence his 17th Division was driving the French left. The 22nd Division occupied Sceaux, on the main road, about six miles in advance of La Ferté. On the other side of the railway and the river Huisne, the 4th Cavalry Division had marched nearly as far as Cosme, which it occupied next





day. The 2nd and 5th Cavalry Divisions were doing their duty in keeping up communications with the 18th Division, and guarding the right against surprise.

January 10th. No great progress was made this day by any part of the Army, except the 3rd Corps. The 17th division gained some ground to the south of Connerre, the 22nd reached Condron Château, and the 4th Cavalry Division entered Cosme. Of the force immediately under the hand of Prince Frederick Charles, the 18th Division, held as a reserve, had still its head-quarters with those of the Prince at Bouloire that night. The 10th Corps drew up its brigades and concentrated near Grand Lucé, General Schmidt's division reached the neighbourhood of Parigné l'Eveque. It devolved upon the 3rd Corps to face the French before Le Mans, and clear the main road and the country on the left nearly, but not quite up to the Huisne, behind which was the main French position.

The corps had its trusted commander, General Alvensleben, who had so led it on the 16th of August before Metz as to check the French Army, and win imperishable fame for himself and the troops he commanded. On that day the 5th Brandenburg Division attacked almost alone, and sustained the combat for some hours before reinforcements arrived, and the months which have since elapsed have neither worn out the spirit of the General nor abated the courage of the men.

Leaving the 12th Brigade to push on beside the high road and clear the woods to the right as far as Champagne, Alvensleben wheeled his three other brigades to the left, and directed them to march by different wood tracks, with their rendezvous for the night at Changé.

The 9th Brigade marching southwards to gain a road which runs direct to Changé, between the great high road and that by which the 10th Corps was advancing, came upon the enemy posted in the woods near Challes, a village on the Narrais, and soon drove them backwards towards Parigné. General Schwerin, marching with the 10th Brigade not far off, heard the firing, and seized the moment to turn the French by attacking Parigné. The result was the capture of two mitrailleuses and many prisoners. He then turned at once towards Changé. The 11th Brigade kept more to the right, and pressed on till it found itself close to Changé, about four o'clock in the afternoon. Then the men were halted to take five minutes' rest, with the sound of the church bell in their ears ringing out an alarm. The rest was short, and the sound of the bell was soon drowned by the rolling fire of rifles and the explosion of bursting shrapnels. The men sang, mocked the hideous crash of the iron missiles, and threw themselves at once into their work like well-trained fox-hounds in a cover. The French had no need of intrenchments, for every field had its banks and hedges. The 35th Regiment (Berliners) scattered into skirmishing order, and the men crept along the hedge sides, or ran suddenly from bank to bank, across the fields, always driving their enemy, but leaving many dead and wounded. At last they gathered together in groups, to dash forward with a mighty cheer, carrying the hamlet Gué la Har, about 1,000 yards short of Changé. They supposed their trials to be over for the day, and it must have

been with disappointment that they found there were many banks yet to be carried, and a natural wet ditch, now covered with ice, to be passed before their quarters for the night were to be won. The evening closed in; the fight raged in the twilight and in the darkness. There was so little light that it was hard to tell friends from foes. The Berlin boys doubted sometimes whether they should fire against some dark group visible against the snow, until there broke from it the war cry in measured accents, "Brand-en-burg; hur-rah!" quickly answered in like fashion. The dead lay thickly, and the wounded, who must surely perish in that bitter night unless room could be won for them in Changé. Still the Châsepôt bullets filled the air, fired at random, but in a fearful leaden storm, from Frenchmen comparatively safe behind banks or in houses. The Prussians were discouraged, but still constant, when they heard sudden firing in advance of them, and to the left of the village much crackling of Châsepôts, and the well-known voice of the needle-gun. Quickly, too, they heard a "Hurrah," and they knew that Changé was theirs; for, as an Officer of the 35th said, "When you hear that sound the Prussians are storming, and it is all over with the French." Still, the ill-fed, thinly-clad soldiers of France resisted, fighting in the streets, crouching and firing from the doorways. The struggle was short but bloody. Whenever man met man at close quarters, and the terrible Châsepôt had no further advantage, the Frenchmen threw down their arms and cried for quarters. Eight hundred prisoners soon lay huddled together in heaps for warmth within the walls of the church, whence the tocsin had sounded that afternoon. The 11th Brigade had borne the brunt of the struggle, and had been helped, when need was sorest, by a flank attack of the 10th Brigade, which turned the position here as it had previously turned Parigné. This action is called by the Germans the battle of Changé.

General Alvensleben would fain have pressed on that night to the Huisne, but he had been delayed too long by the resistance at Parigné and Changé. His men were exhausted, and snow was falling heavily. The outposts were placed in front of the village, and it was nearly midnight before all the men were sleeping on the bare floors, or, at the best, on a little straw found in the stables. Changé had been named for their nightly quarters, and in Changé they lay.

January 11. We have now come to the two days' severe fighting called by the Germans the battle of Le Mans. The position of the French was of great strength. The army of Prince Frederick Charles was advancing from the east by three roads. On the right the 18th Division was on the grand *chaussée* from St. Calais and Vendôme. On the left the Hanoverians, delayed, it will be remembered, at Montoire, had been toiling along the glassy high road from Château du Loir to Le Mans, and had now to clear and hold the country between that highway and the Parigné-Le Mans road, General Schmidt being sent rapidly forward to turn the great town and act upon the rear of the French or pursue them in case of retreat. Hard as they strove, the Hanoverians could win no further with their most advanced division than Les Mortes Aures, a little place on the Château du Loir-Le Mans road, at a spot which will be found by describing a circle with Le

Mans for centre and radius, about 800 yards short of Changé. Such a circle would also pass close to Yvré. The other Division, the 19th, had only reached Mulsanne; part even of the 20th Division was Ruaudin. There, on the evening of the 11th, the 10th Corps was still further from Le Mans than Changé, taken by the 3rd Corps on the 10th. The 18th Division was also further off to the right rear. The gallant Brandenburgers faced the centre of the French position and almost overpowering forces of the enemy. Let us see what they had before them.

Eastwards of Le Mans there are three great roads converging on the town, besides the railroads, which may be left unnoticed, as they were not used in any way, either for attack or defence. The first, from the north-east, is the way by which the Grand Duke was advancing, driving in the left of the French. For strategical purposes it must be considered as double, one branch running down the Huisne, the other farther westwards, through Bellême, Bonnetable, and Savigne. The second, from St. Calais, was the way along which the Chief Command was moving, protected by only one division. The third leaves Le Mans in a south-easterly direction, and separates at Pont Lieue—a suburb of the great town—into three branches, two of which are now important, because the 10th Corps occupied them both on the night of the 11th. The more northerly of the two is that from La Chartre through Grand Luce and Parigné. South of it is the great Tours road through Château du Loir. Observe the course of the rivers and streams, for rivers in a hilly country mark the feet of the hills. The Sarthe runs due north and south through Le Mans, and the Huisne, with its northern tributaries, forms a curve round the town and in front of it. Therefore, as the country is hilly, you will see that there must be a curving range of hills forming a grand natural parapet in front of Le Mans, with the Huisne for its ditch, but that there is a valley near Pont Lieue through which the Huisne pours its waters into the Sarthe. This is, then, a weak place. Follow the course of the Huisne upwards, and it will be seen that it is fenced off from the great Vendôme-St. Calais road by a range of hills running from the north-east directly towards Le Mans, but stopping short, and dropping their slopes to meet the Huisne at Yvré. So, then, the Germans had a mighty earth heap thrown up against them by Nature behind the river, and the approach to it from St. Calais was commanded from the right by the range above Champagne, the heights being occupied by French infantry and artillery. On the far bank of the Huisne, a river not to be forded, and now half covered by a thin coating of ice, on the top of the huge parapets, were guns, mitrailleuses, and Gatling machine guns, planted thickly. All the bridges over the Huisne were held by the French. The line of retreat taken by the troops driven in by the Grand Duke must of necessity be behind the Huisne and along the road and railway running side by side half-way between the crest of the hills and the stream. So the three Divisions—18th of the 9th Corps, 5th and 6th of the 3rd Corps—had in front of them, across the Huisne, at one time or another, almost the whole of the French army, and this while the passages of the river were all in the hands of the enemy. Cautious

and timid commanders would have hesitated, perhaps retired from the imminent danger. But neither Prince Frederick Charles nor Alvensleben of Mars-le-Tour is a timid commander. "The whole country is full of woods, right down to the Huisne. Let us attack and the French will never know how weak we are."

So the 18th Division was given for its task to carry the hills above Champagne, nearly parallel to the high road, and the 3rd Corps had the audacity to march straight against the Huisne. The hills of Champagne were partly carried in front, partly cleared from their end along the crest, and partly turned. Another outwork of Nature's defences of Le Mans was in the hands of the Prussians. Still the passage of the Huisne at Yvré was in the hands of the enemy, and the Grand Duke on the right seemed long in coming.

It was not till the middle of the day that the 3rd Corps had the order to advance. His corps had left Orleans some 22,000 strong, and had been fighting its way in terrible weather ever since. Cavalry were put out of all calculation by the nature of the country, the state of the roads, and the impassable Huisne. If Alvensleben's force be estimated at 16,000 men in line of battle, I believe that every man will have been counted. It is as yet impossible to state the numbers of the French. Before the battle they called their strength 200,000 men and 400 guns. After their defeat they asserted that they were only about 100,000. The Prussians reckoned them at 120,000 to 140,000. It is certain that in all but cavalry they far outnumbered the forces of Prince Frederick Charles, and cavalry could not act, because of the slippery roads.

The ground was covered with woods, chiefly pine trees, intersected by numerous lanes, often sunken, always separated from the woods by ditch and bank. Here and there occurred patches of cleared land, and then the fields, with farmhouses and orchards surrounded by fences exactly like those most common in England—a small ditch and a hedge on the top of a bank, just high enough to be a good defence for soldiers to fire from behind. It is true that the French had not known how to prepare these artificially, but they were strong enough of themselves. The woods swarmed with French riflemen, and beyond, always within range, were the hills across the river, dotted with field guns, Gatlings, and mitrailleuses, thick as flies on honey in summer. Whatever be the number of a Prussian force, it always endeavours to turn the enemy's flank, and by that means guards its own on that side. The 10th Brigade, consisting of the 12th and 52nd infantry regiments, with the usual proportion of cavalry and artillery, cavalry of no avail, guns of little use, was sent westwards to try and gain the road Parigné-Le Mans; the 11th Brigade, 20th and 35th, was directed north-west upon Chateau les Noyers, about 500 to 600 yards from the Huisne; the 12th Brigade, 24th and 64th, called in that morning from the main road, was given Yvré for its point of attack; the 9th Brigade, 8th and 48th Regiments, was held in reserve.

Then was seen a battle of heroes. As yesterday, so now, the 11th Brigade fell into the thickest of the fight. It reached Chateau les Noyers, and the 35th (Berliners) stretched their right as far as

Chateau les Arches, about 1,600 yards from the French batteries on the opposite hill, whence came a perfect drift of iron, while the Chasse-pôts poured in their leaden hornets as thickly as hailstones. The iron storm was less at Les Noyers, the hail of lead was closer both from Chassepôt and Gatling. In some places there is not a tree unmarked by many bullets, and it is marvellous how men could lie, for they could not have stood there and lived. The 35th was too daring, and pushed forward beyond possibility of holding its ground. It was driven back by sheer weight of iron and lead to Les Noyers. Finding that there was work enough for the present without Yvré, while the high road was safe in the keeping of the Prince with the 18th Division, the 12th Brigade attacked Les Arches and drove the French infantry headlong out of it. The divisional artillery came up and opened at 1,600 yards against the batteries opposite, 1,800 against others more to the left, above the road, for Les Arches lies at the edge of the woods, where they break off to leave room for a few gardens and fields by the banks of the river. For a few minutes shells from both sides of the stream shrieked as they flew across on their errand of death, almost meeting on the way, but the Prussian projectiles only burst after striking, and dive innocuously into the earth when they strike the opposing side of a hill. Besides, they were outmatched in number of guns, and the French gunners knew the distance exactly. The pretty château was wrecked by the fire from the heights, though the men within it retained their grim humour, and wrote "Music" on most of the doors while the uproar was at its height. The guns could not be worked long in face of the French fire, and were driven to limber up and retire.

Towards evening the 8th Regiment was sent forward from the reserve, and came in time to assist in meeting the shock of 25,000 to 30,000 Frenchmen, pushed forward to make the road and railway assured, and enable the swarms of men retreating before Mecklenburg to pass into Le Mans. In the evening, too, Captain André galloped across country to an open spot near Les Noyers, where he suddenly appeared in the midst of the French fire, just time enough to see long columns moving in retreat along the road across, but parallel with, the river. It was the commencement of the French retreat, just when they ought to have pushed steadily forwards. Meanwhile the 10th Brigade had not been much more fortunate. All that skill and bravery could do was done, and the dead and wounded were heaped wherever an open space had to be crossed. Men may shoot badly from the enemy's side, but if the whole air is full of bullets little progress can be made. Hardly any way could be made till the 10th Corps began to press up along the road. It was a grand and a gallant feat of arms, that battle of the 3rd Corps, but in the evening the men had to be drawn in, and General Alvensleben said that he was disappointed. He had hoped to have penetrated with his own corps through an enormously superior force, and to have stood in the middle of the French Army! Up to dark, the 20th held the woods, the 35th Les Noyers, and the 24th Les Arches. On this day, the 11th, the head-quarters of the Grand Duke were at Connerré, the 17th Division at Lombron,

and the 22nd at La Chapelle. The 4th Cavalry Division was at Chanteloup.

That night the staff of the 3rd Corps slept on straw in a room of the curé's house at Changé, knowing that the enemy was close to them in heavy force. The Gatling gun, a new weapon to them, had made a considerable impression, though the French had blundered as usual in using it against woods at long ranges, where they should have employed common shells with percussion fuses to tear off branches and bring down whole trees, even filling the air with ragged masses of iron. The Prussian officers had not yet quite come to understand the new arm, with its solid lead projectiles, and many were the attempted imitations of its rapidly repeated thud. As the Officers were sitting on their straw in the early morning of the 12th, stretching their arms to get the cramps out of them, there was a sudden alarm, and firing so close that it seemed almost to be in the garden. It was the last push forward of the French, who ought to have always pushed forward, and it was now only intended to cover their retreat on Le Mans, whither their guns had been moving all night.

On the 12th, therefore, early in the morning, began the second part of the battle of Le Mans. On this day the Grand Duke was able to move his own head-quarters to Montfort; the 17th Division was at St. Corneille, and the 22nd at La Croix. The 4th Cavalry Division was eastwards of Ballon, where it moved on the 13th, in company with the 22nd Infantry Division. On the 13th also the 17th Division was at Neuville-sur-Sarthe. The 13th Corps had done its work, and was already marching in a new direction. What it was to do there I have no doubt you have heard by this time.

It was hardly understood by the Prussians that the French were actually in full retreat on the 11th, and Chanzy's attack on Les Noyers on the morning of the 12th caused some anxiety. But it was groundless. The guns had almost gone from the hill, and after early morning the thud of the Gatling was no longer heard. It is said that Chanzy had received strict orders to carry off his guns, whatever happened, and this may have caused the feebleness of his tactics. Either he was hampered by conditions, or was ill-informed, or could not trust his men. However that may be, he certainly ought to have attacked. There was one period on the 12th, when the whole of the 18th Division had been sent to help the Grand Duke except two companies, and these were all that stood on the main road. The Prussians were not slow to perceive the gradually lessening power of the French. On the morning of the 12th the 6th Division took Yvré with little fighting, and mounted to the plateau, cutting off the retreat of the French in that direction. The 10th Corps and General Schmidt, after some fighting on the road, reached the heights before Le Mans, and threw some shells into the town on the retreating columns of the French. The 5th Division, now released, followed in the same direction by the road Changé-Ponthève-Le Mans, and, finally, the columns penetrated into the town. To carry off his guns and infantry Chanzy had to leave much of his train behind him in the squares of the town, and when the Prussians believed all resistance to be over fire was

opened upon them in the dusk, both in the great square by the cathedral and in the market-place. The 10th Corps lost, they say, at least 100 men in the streets, and an Officer, confirming the general report, assured me that the French bullets, striking the walls of the houses and the men's bayonets, exploded with a report and a bluish flash. This may be quite true, and yet accidental, for I know that the French Government possessed some explosive bullets at the beginning of the war, though there was no intention of using them.

Next day the Prince, who had held his head-quarters during the two previous days at Château Ardenay, moved into Le Mans. The Grand Duke moved at once towards Alençon, and from thence to Rouen, left unoccupied because Mauteuffel with the bulk of his army had been called to the south-east to the help of Von Werder against Bourbaki. The 18th Division pushed on and occupied the intrenched camp at Conlie vacated by the French. The 10th Corps, after a short rest, moved upon Laval, but found bridges blown up and too much opposition to be overcome by so small a force. The 3rd Corps remained in Le Mans to enjoy its well-earned rest, but was soon in front of the town, having relieved the 10th Corps.

By the occupation of Le Mans and Conlie, a great mass of material, railway carriages, engines, food, arms, and ammunition fell into the hands of the Prussians. Alençon followed its fate.

The battle of Le Mans decided the fate of Paris, and therefore that of France. For if Chanzy could not stand before Prince Frederick Charles when Bourbaki was also in the field and Paris detained before her walls the bulk of the German Army, it is certain that he could have done nothing against the Prince when heavily reinforced as he was immediately after the fall of Paris.

The Prussian system has been triumphant in the war, and France is almost sure to adopt something closely approaching to the organization of its late enemy. Probably each nation in Europe is making up its mind what steps it will take to be stronger for war since it has been shown that strength and economy can go hand in hand. What are we to copy? Are we indeed to copy anything, or are we to refuse to learn any lesson at all? According to my humble judgment, we ought not to copy the universal service, nor conscription of any sort. I believe we shall get plenty of men without resorting to such means, if only we will appeal to the old country spirit by adopting local corps. This, with the facility it gives for instant mobilization, is the one grand point for us to aim at. The smaller an Army, the more necessity for its being ready to be used suddenly and with effect.

Autumn manœuvres are, it is said, to be tried this year, and we may hope that there will be between Officers and farmers a mutual spirit of kindness and good feeling, so that, at last, military training of the Army may even come to be considered as a wise measure, and divide popular sympathy with great national sports, such as hunting.

But I am convinced that the district corps organization, with the possibilities dependent upon it, is at the root of all military efficiency, and is eminently in harmony with the decentralizing spirit, the

institutions, and the prejudices of dear, blundering, honest old England!

This is what the old country should start afresh upon; this the example she should set to her colonies. All will then be working in harmony, and preparing for that future time when a mighty confederation of English speaking lands shall have power to prevent such crimes against humanity as the war of 1870-71.

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